ACADEMY OF SCIENCES OF THE U.S.S.R.

Mikhail Nesturkh

The ORIGIN of MAN

FOREIGN LANGUAGES PUBLISHING HOUSE
Moscow · 1959

TRANSLATED FROM THE RUSSIAN BY GEORGE H. HANNA

The Russian edition of this book, edited by Professor Y. Roginsky, was published by the Academy of Sciences of the U.S.S.R. in 1958. The present translation has been read and approved by the author.

CONTENTS

Page

Preface 5

PART ONE

THE DARWIN AND OTHER HYPOTHESES CONCERNING ANTHROPOGENESIS

Chapter One. DARWIN ON THE ORIGIN OF MAN

1. Anthropogenesis Before Darwin 9
2. Darwin on the Evolution of the Animal Kingdom 14
3. Darwin's Genealogy of Man 18

Chapter Two. THE ANTHROPOID APES AND THEIR ORIGIN

1. Living Anthropoids 30
2. Extinct Anthropoids 45

Chapter Three. CRITICISM OF THE LATER HYPOTHESES CONCERNING THE ORIGIN OF MAN

1. Religious Explanations of Anthropogenesis 64
2. The Tarsier Hypothesis 68
3. Some Simian Hypotheses 73
4. Osborne's Hypothesis 80
5. Weidenreich's Hypothesis of Anthropogenesis 88

PART TWO

PHYSICAL PECULIARITIES OF THE HUMAN BODY AND THE EMERGENCE OF MAN

Chapter One. THE ROLE OF WORK AND ERECT LOCOMOTION IN ANTHROPOGENESIS

1. The Role of Work 97
2. Methods of Locomotion of the Great Apes 100
3. The Weight of the Body and the Centre of Gravity in Man and the Apes 108
4. The Inferior Extremities 110
5. The Pelvis, Spine and Thorax 116
6. The Superior Extremities 122
7. The Proportions of the Body and Asymmetry 128
8. The Skull 131

Chapter Two. THE BRAIN AND HIGHER NERVOUS ACTIVITY IN MAN AND THE APES

1. The Brain and Analysers of Man and the Apes 142
2. Development of the Peripheral Regions of the Analysers 153
3. Higher Nervous Activity in Monkeys 168
4. The Second Signalling System – the Distinguishing Feature of Human Thought 185

Chapter Three. THE HERD INSTINCT IN MONKEYS AND RUDIMENTARY FORMS OF LABOUR
1. The Herd Instinct in Monkeys 189
2. Inceptual Forms of Labour 208

PART THREE

PALAEANTHROPOLOGICAL DATA ON THE MAKING OF MAN

Chapter One. THE FIRST STAGE: THE EARLIEST MEN (PITHECANTHROPI)
1. The Java Pithecanthropus 215
2. The Sinanthropus 224
3. The Heidelberg Man 236

Chapter Two. THE SECOND STAGE: EARLY MEN (PALAEANTHROPI)
1. The Ice Age 239
2. Neanderthalers and Their Physical Type 244
3. Neanderthalers on U.S.S.R. Territory 254
4. The Palestine Neanderthalers 262
5. Primitive Man's Way of Life 271
6. The Development of Fossil Man's Brain 276

Chapter Three. MODERN MAN (NEANTHROPUS)
1. Upper Palaeolithic Man 288
2. False Hypotheses Concerning the Origin of Modern Man and Their Criticism 304
3. The Races of Mankind 314
4. Science Against Racism 325

Bibliography 329

I dedicate this book to my wife,
Ekaterina Mikhailovna Nesturkh

PREFACE

The problem of the origin of the human race is one that has been awaiting a solution for thousands of years. Religion had shed a false light on it and it remained a mystery until the last century when biological knowledge had become more extensive and Darwin was able to propound a materialist theory of the evolution of the organic world.

The logical outcome of this theory was the proof that man and the animals have a common origin. Darwin assembled a vast amount of data confirming the idea of man's natural origin and established beyond all doubt that a species of the most highly developed, extinct bipedal ground apes was the immediate ancestor of man.

The thesis of man's descent from an ape became basic in anthropogenesis; it is the corner-stone of anthropology.

The materialist theory of the origin of man is diametrically opposed to the idealist, religious conception of the miraculous creation of "first men." Biology and anthropology, however, were unable to provide a complete explanation of the process of anthropogenesis because social as well as biological factors played their part in the development of the human race.

This is particularly true of the last phase in the formation of man, when the body acquired its present structure and the species *Homo sapiens* branched out into different races.

The process of anthropogenesis is vastly different from the phylogenic development of any species of the higher vertebrates, even of the apes. The problem, therefore, requires a complex approach employing data established by the social sciences that have Marxist philosophy as their basis.

A comprehensive solution of the problem under discussion can only be made from the standpoint of dialectical and historical materialism; Marxism-Leninism has enabled anthropologists to make a profound and truly scientific analysis of the very essence of anthropogenesis. Dialectical materialism, a method the present author has endeavoured to apply in his work, is a most powerful weapon in the struggle against idealist concepts of the origin of man.

The primary purpose of this book is to provide readers with concrete facts, drawn from present-day biology, to serve as proofs in the materialist theory of anthropogenesis. These include the most important information on the living anthropoid apes necessary to make a correct study of the fossil remains of their extinct ancestors, to find among them the immediate precursors of man and to discover the main features of their palaeobiology.

The second task which the author has set himself is to outline the more significant stages in the development of fossil man.

The third task is to explain the anthropological viewpoint of the way in which fossil man developed, using for this purpose the labour theory of anthropogenesis, and also to criticize the idealist concepts of the formation of man and the races of mankind.

The author has made extensive use of the investigations of anthropologists, anatomists and physiologists studying the structure of the human body, as well as the work of archaeologists and ethnographers. He has also drawn material from his *Man and His Ancestors* (1934) and other works.

M. F. NESTURKH
Institute and Museum of Anthropology,
Moscow State University

PART ONE

THE DARWIN AND OTHER HYPOTHESES CONCERNING ANTHROPOGENESIS

CHAPTER ONE

DARWIN ON THE ORIGIN OF MAN

1. ANTHROPOGENESIS BEFORE DARWIN

From the earliest times various peoples have created legends about the miraculous creation of the first man by some deity. In these myths we may trace the influence of the natural, social and economic environment of those who created them. The biblical legend of the creation of the first man by God who breathed some part of his own spirit into him and gave him his "immortal soul," for example, is a clear reflection of the potter's craft and the sculptor's art, both of which were widespread in Assyria, Babylon, Egypt, Judea, and other countries at the time the myth took form.

The Muslim myth of the creation has points of similarity with that of the Bible: "He excelled in the making of all things. He first created man of clay, then bred his offspring from a drop of paltry fluid. He moulded him and breathed into him of his spirit."

Nevertheless, from time immemorial people had noticed the great resemblance between man and the other animals and this led them to the idea that man had a natural rather than a supernatural origin. The idea was first broached in the times of antiquity by Lucretius (95-51 B.C.) in his materialist poem *On the Nature of Things* (*De Rerum Natura*). His idea was that the first people were born directly out of the Earth at a time when it possessed mighty fertility; the Earth produced animals, birds and other living beings after it had become covered with all kinds of vegetation.

Although Lucretius' concept of the appearance of people as babies born of the "wombs of Earth" is absolutely fallacious, it is significant that he rebelled against the stultifying influence of religion: in his poem man was born of the Earth in a natural manner.

The atheistic essence of Lucretius' poem can be judged by the following remarkable lines:

Humana ante oculos foede cum vita iaceret
In terris oppressa gravi sub religione
Quae caput a caeli regionibus ostendebat
Horribili super aspectu mortalibus instans,
Primum Graius homo mortalis tollere contra
*Est oculos ausus primusque obsistere contra.**

Lucretius then goes on to say:

Principium cuius hinc nobis exordis sumet,
*Nullam rem ex nilo gigni divinitus umquam.***

With amazing intuition Lucretius drew a picture of the life of primitive man, his work and the beginnings of articulate speech. Lucretius' poem is in keeping with the materialist ideas of Epicurus (born 324 or 341, died 270 B.C.), the great Greek atheist and writer, and is significant as one of the first attempts to picture the appearance of man on Earth as a natural phenomenon and not by the miracle of divine creation.

In his poem Lucretius made use of the achievements of the thinkers and scholars of the preceding centuries. The great intellects of antiquity analysed the chief peculiarities of the human body and its organs and established the important fact that the hand is the organ of universally useful work. This fruitful idea is met with in the works of the philosophers Anaxagoras (500-428 B.C.) and Socrates (circa 469-circa 399 B.C.). Anaximander (sixth century B.C.) and Empedocles (490-430 B.C.) spoke of the natural development of man.

In the works of Aristotle (384-322 B.C.), Hippocrates (circa 460-circa 377 B.C.), and other great naturalists and physicians of the ancient world, we find some scientific foundations for the investigation and description of points of difference and similarity between man and the other mammals; these include the structure of the body, its development and functions. Of those mentioned above Aristotle made the greatest contribution: he was the first to make a detailed study of the human body and showed the place occupied by man in the animal kingdom; he also pointed out such cardinal differences between man and the other animals as his erect posture and gait, his big brain, speech and intellect, and conducted an analysis of those features.

Somewhat later the Roman physician and anatomist, Claudius Galen (circa 130-circa 200 B.C.), established the great similarity in the structure of the body of man and the monkeys and noted points of similarity and difference with the other animals. Galen's works, like those of Aristotle, brought him great prestige and fame that lasted

* When the life of man lay foully grovelling before our eyes, crushed beneath the weight of a Religion, who displayed her head from the regions of the sky, lowering over mortals with terrible aspect, a man of Greece was the first that dared to raise mortal eyes against her, and first to make a stand against her.

** . . .Reason and the contemplation of nature; of which our first principle shall hence take its commencement, that nothing is ever divinely generated from nothing.

a thousand years. Knowledge of man and of the animal kingdom gradually increased as the productive forces in human society were developed.

The anatomy and physiology of man were gradually built up from scanty precise knowledge and a mass of vague assumptions. After the reform of research methods, mainly due to the work of Andreas Vesalius (1514-1564) and William Harvey (1578-1657), scientists began to gain real knowledge of the human body. They began to understand much of what had been, until then, incomprehensible in the structure of man's body. A materialist view of the human being began to gain ground amongst scholars.

Even in the darkest days of the Inquisition, advanced scholars propounded the truly materialistic idea of the natural and not miraculous origin of man. One of these, for example, was Lucilio Vanini (1585-1619) who was condemned by the Inquisition and burnt at the stake for his materialist and anti-religious conception of man and nature.

In the history of science, of special importance to anthropogenesis was the increasing knowledge of monkeys, especially the anthropoids. The chimpanzee was first brought to Europe at the beginning of the seventeenth century. In 1699, Edward Tyson, an English anatomist, published a full description of the structure of this ape in his monograph: *Ourang-outang, sive Homo sylvestris: or, the Anatomy of a Pygmie Compared with that of a Monkey, an Ape and a Man.*

In the eighteenth century the famous Swedish scholar, Carl Linnaeus (1707-1778), in his classification of the animal kingdom, included man and placed him in a special genus, *Homo*, with the species *Homo sapiens* next to the anthropoid apes.

Linnaeus' views, however, were those of a creationist: he believed the intellect to be a particle of divine wisdom in man.

At the end of the eighteenth century the idea of the natural origin of man is also seen in the works of James Monboddo (1784), where he dealt with the question of the origin and development of articulate speech. Later, J. E. Doornik (1808), like Monboddo, asserted that man had descended from the anthropoid apes.

One of the most famous biologists of the latter half of the eighteenth century was Georges Buffon (1707-1788) who, as a transformist, devoted considerable attention in his works to man as well as to the anthropoid apes that he had personally observed. However, he very sharply differentiated man from the animal kingdom on account of his intellectual qualities which he believed to be of divine origin.

By the beginning of the nineteenth century considerably more knowledge of the people, fauna and flora of many countries had been accumulated. Greater knowledge of fossil animals and of the history of the Earth, had also been obtained as can be seen from the works of Georges Cuvier (1769-1832) and Charles Lyell (1797-1875). In addition to zoology and palaeontology, other branches of knowledge were extensively

developed. The idea of the immutability of species of animals and plants, supported by the majority of scholars after Linnaeus, gradually began to lose ground. Individual biologists began to get a clearer conception of certain signs of evolution in the organic world.

One of the earliest Russian scholars to give expression to the ideas of transformism was Afanasy Kaverznev (born 1748, date of death unknown). His dissertation on *The Transmutation of Animals* was published in 1775. In his book this progressive scholar cited numerous facts to support his theory of the natural origin and further transformation of species. Nor did he hesitate to apply his tenets to the development of man. Kaverznev placed man and the apes in one group and asserted that they and the other animals possessed similarities and were related: "... not only the cat, lion and tiger but man and the apes and the other animals constitute one single family" (*The Transmutation of Animals*, p. 507).

Somewhat later we find materialist ideas concerning man and his origin expressed in the works of one of the most outstanding public men and thinkers of his time A. Radishchev (1749-1802); in his *On Man, His Mortality and Immortality* he expresses the opinion that the science of man is the most important, is fundamental.

In the same treatise proof is offered that "the hands were man's guide to reason."

This perfectly just idea is met with several times in the works of N. G. Chernyshevsky (1828-1889), the nineteenth century Russian revolutionary democrat and thinker. He subjected such cardinal problems to analysis as man's place in the universe, the nature of man and man's origin as the result of the normal historical development of nature.

In his essay, *The Anthropological Principle in Philosophy*, Chernyshevsky, as a materialist philosopher, asserts the unity of man's body and spirit: this fundamental thesis was later confirmed by the researches of I. M. Sechenov (1825-1905) and I. P. Pavlov (1849-1936) who laid the foundations of Russian materialist physiology. Chernyshevsky said in his essay: "... a man must be regarded as a single being having only one nature; ... a human life must not be cut into two halves, each belonging to a different nature; ... every aspect of a man's activity must be regarded as the activity of his whole organism from head to foot inclusively, or if it is the special function of some particular organ of the human body we are dealing with, that organ must be regarded in its natural connection with the entire organism."*

In other countries Darwin's greatest predecessor in the field of biology was Jean Lamarck (1744-1829) who, in his *Philosophy of Zoology* (1809), gave proofs of evolution in the animal and vegetable kingdoms and thereby opposed the widespread metaphysical conceptions of his time.

---

* N. G. Chernyshevsky, *Selected Philosophical Essays*, Moscow 1953.

Lamarck maintained that all modern organisms derived from ancient forms by means of evolution. He believed it possible that in the course of time man himself could have descended from some kind of ape. The ancient anthropoid ape had been forced to abandon his arboreal life when the forests grew thinner and take to ground life on two legs. His upright gait wrought changes in his spine, muscles, feet, hands, jaws, teeth and brain. Social life soon led to the development of articulate speech. Lamarck expressed many correct ideas in his theory of a possible way for man to have developed naturally.

Engels, it will be remembered, had a very high opinion of Lamarck's work on evolution. In his criticism of idealistic conceptions of the development of nature, he wrote: "This absurdity of a development in space, but outside of time—the fundamental condition of all development—Hegel imposes upon nature just at the very time when geology, embryology, the physiology of plants and animals, and organic chemistry were being built up, and when everywhere on the basis of these new sciences brilliant foreshadowings of the later theory of evolution were appearing (for instance, Goethe and Lamarck)."*

And Lamarck really did propound, in addition to his conception of the mutability and perfection of organisms, the principle that the organism is affected by its environment and by training, as well as the thesis that individually acquired peculiarities are transmitted by heredity. At that time there was still insufficient proof available of the evolution of organisms in nature and of the natural origin of man. Lamarck did not touch on other important developmental factors so that his evolutionary theory was one-sided and could not overcome the old theory of the immutability of species.

Other evolutionists of Lamarck's time such as Etienne Jeoffroy Saint-Hilaire (1772-1844) also lacked sufficient data to support the theory of evolution. Georges Cuvier (1769-1832) was the most important of those who supported the theory of the immutability of species since the creation of the world; despite this, he was one of the greatest French naturalists and palaeontologists and he also worked on comparative anatomy. The evolutionists suffered a defeat in the dispute, held in the Paris Academy of Sciences in 1830 between Cuvier and Saint-Hilaire on the question of a single type of structure in vertebrates and invertebrates (Amlinsky, 1955).

Within half a century of the publication of Lamarck's *Philosophy of Zoology* great advances were made in man's knowledge of nature. The works of Charles Lyell marked great progress in geology in particular and there was a clearer understanding of changes taking place in the strata of the Earth's crust and of the fossil animals and plants it contains.

* F. Engels, *Ludwig Feuerbach and the End of Classical German Philosophy*. See K. Marx and F. Engels. *Selected Works*, Two-Vol. ed., Vol. II, Moscow 1958, p. 374.

The idea of evolution in man's environment became more frequently the subject of scientific thought. At last there appeared a great naturalist who was able to connect the tremendous accumulation of facts into a single whole on the basis of the laws of development in the organic and inorganic worlds. This was Charles Darwin whose writings are today amongst those of the greatest scientists of all times.

2. DARWIN ON THE EVOLUTION OF THE ANIMAL KINGDOM

Charles Darwin was born in 1809 in the town of Shrewsbury in England. In his youth he made a five-year voyage round the world as naturalist on board the *Beagle* and gathered an enormous amount of material on zoology, botany, palaeontology and geology that gave him the idea of the mutability of species and, in general, made a great impression on his receptive mind. On his return to England Darwin settled in the village of Down, not far from London, where he wrote his books. He died in 1882.

Darwin's great contribution to science was his establishment of the principle of artificial selection by means of which changes in the breeds of animals and plants are mainly effected by man. But still more important was Darwin's discovery of the natural selection that transforms species of animals and plants in nature and is closely bound up with mutation and heredity.

We must also mention that in later editions of his book *On the Origin of Species by Means of Natural Selection* he wrote that modifications acquired and constantly employed during many centuries for some useful purpose would most probably become stable and might be transmitted by heredity.

Engels did not attach such paramount importance to natural selection as Darwin did, but he stressed the importance of the influence of environment, mutation and heredity. Engels wrote that "... from the simple cell onwards the theory of evolution demonstrates how each advance up to the most complicated plant on the one side, and up to man on the other, is effected by the continual conflict between heredity and adaptation."*

Darwin's theory of evolution delivered a severe blow to the conception of the immutability of species that had been dominant before him. Darwinism was a theory that revolutionized all biology, and the idea of evolution began to enter with greater force into various branches of natural history and find its confirmation. Darwin's contemporaries likened his theory to a bomb thrown by the great scientist into the camp of the clericals.

In the following words D. I. Pisarev (1840-1868) describes the impression created on contemporaries by the theory of natural selection:

* F. Engels, *Dialectics of Nature*, Moscow 1954, p. 280.

"In nearly all branches of natural science Darwin's ideas bring about a complete revolution: botany, zoology, anthropology, palaeontology, comparative anatomy and physiology and even experimental psychology find in his discoveries the guiding principle that will link up the numerous observations already made and put investigators on the way to new fruitful discoveries."*

Pisarev especially welcomed the application of the theory of evolution to man since he was convinced that "... the greatest number of errors, both theoretical and practical, should concern man as the most complex, the least known and at the same time the most interesting object in nature."**

Marx and Engels put a high value on Darwin's theory because it dealt a death blow to teleology and shattered the metaphysical theory of the purposefulness of living nature. "In this field teleology was still not crushed but now it has been," Engels wrote to Marx in 1859. Two years later Marx wrote to Lassalle on the same subject: "Darwin's book is very important and serves me as a natural-scientific basis for the class struggle in history."***

At the same time the founders of Marxism noted some significant shortcomings in Darwin's theory, especially his uncritical application of social laws to biology and, on the contrary, his biological approach to social phenomena. Darwin, for example, was uncritical in his attitude to the reactionary teachings of the English clergyman and economist Thomas Malthus, according to whom the human race tends to increase faster than the food supply which must inevitably lead to "a struggle of all against all," that is, to "competition within the species": under cover of the "struggle for existence" Malthus tried to take the sharp edge off the class struggle of the exploiters against the working population. Darwin succumbed to this theory and gave excessive importance to the intraspecies struggle and to competition in nature.

Soviet biologists have raised Darwinism to a higher level on the sound basis of the method of dialectical materialism, have shown the weakness of this side of Darwin's theory and have developed the conception of the interspecies struggle of organisms.

The confusion of biological and social categories was due to the bourgeois narrow-mindedness of Darwin himself. For this reason, also, Darwin was unable to provide a full solution to the problem of the origin of man. This was done later by Marx and Engels on the basis of dialectical materialism. The reactionary section of the bourgeoisie was extremely hostile to Darwin's theory of the evolution of the organic world. All the more hateful to them were his views on anthropogenesis

* Dmitry Pisarev, *Selected Philosophical, Social and Political Essays*, Moscow 1958, p. 304.

** *Ibid.*, p. 235.

*** Marx-Engels, *Selected Correspondence*, Moscow 1955, No. 52, p. 151.

since they dealt with man himself. Seeing, however, that Darwin's theory was built up on a sound foundation many reactionaries began to raise the level of the struggle for existence to the status of the chief law in nature and in human society.

At that time one of Darwin's most brilliant successors, Ernst Haeckel (1834-1918), played an important, positive part in spreading Darwinism in Germany and other countries. He developed the idea of man's relationship to the animal kingdom. Haeckel, however, carried the struggle for existence in nature into human society and thus facilitated the development of the so-called "social-Darwinism." The "scientific" concept of the social-Darwinists is that the exploiting classes are "biologically superior" and the working classes "inferior," in consequence of which the latter should be subordinated to the former.

From the viewpoint of the social-Darwinists the winning side is the more perfect. By treating social phenomena biologically the social-Darwinists tried to hide the real state of affairs and use Darwin's theory to strengthen the position of capitalism.

Darwin himself regarded natural selection as an evolutionary factor only in the early stages of man's formative period. As far as modern man is concerned Darwin admitted selection in a secondary form and on a very small scale.

K. A. Timiryazev, the great Russian biologist, said the following about social-Darwinism: "In part ... zealous thoughtless champions of Darwin's ideas, and to a greater extent his unconscionable or ignorant opponents hurried to ascribe to him the idea that the struggle for existence, as understood in its crudest, animal form, should be recognized as the guiding law and should direct human history, completely ignoring the conscious influence, the conscious reflex, of mankind on its future.... Would he, whose every word breathes humanism, have preached the ideals of a cannibal?"

Many progressive Russian scholars, contemporaries of Darwin, carried out independent research in the field of evolution. Darwin showed great esteem for the work of the brothers Alexander and Vladimir Kovalevsky (1840-1901 and 1842-1883), embryologist and palaeontologist. The principles established by Vladimir Kovalevsky had and still have great importance for the understanding of the evolution of mammals, including fossil apes: he laid the foundations of evolutionary palaeontology and was one of the most brilliant representatives of Russian materialist biology in the latter half of the nineteenth century—the first period in which Darwinism flourished.

Darwin's works are profoundly materialist. His theory of the natural origin of man from the animal world is a powerful weapon in the struggle against religion.

Of great importance in this respect is his *Descent of Man and Selection in Relation to Sex* in which he mustered the more important proofs of man's descent from the animal kingdom.

Darwin began collecting these proofs some thirty years before the book appeared. As early as 1837-1838 he recorded the great idea of the relationship of man and animals in his notebook: "If we choose to let conjecture run wild, then animals, our fellow brethren in pain, disease, death, suffering and famine—our slaves in the most laborious works, our companions in our amusements—they may partake (of?) our origin in one common ancestor—we may be all melted together."*

Parallel to his work on the new theory of evolution Darwin gave much thought to the question of man's origin.

For Darwin, as a naturalist, this problem was the loftiest and most interesting, although it was surrounded by prejudice, as he wrote to Wallace in 1857, i.e., two years before his basic work on evolution appeared.

Darwin was well aware of the anti-religious significance of his work on anthropogenesis, for in 1860 he wrote that although all people had the right to believe in the creation of man as a special miracle he could see no need for it and thought it dishonest to conceal his opinion. Ten years later, in 1870, he said in a private letter that the book he was publishing that autumn dealt in part with man and he was sure many people would condemn it as irreligious.

This is not at all surprising, for in his work on the descent of man we read: "He who is not content to look, like a savage, at the phenomena of nature as disconnected, cannot any longer believe that man is the work of a separate act of creation."** There are, furthermore, a number of other statements by Darwin to the effect that he hoped to do mankind a great service through his book by refuting the dogma of acts of creation.

Darwin's book, *The Descent of Man and Selection in Relation to Sex*, appeared in 1871. It was in the nature of an extended interpretation of the one, but very significant, phrase on man in his basic work, *On the Origin of Species* (1859): "Light will be thrown on the origin of man and his history."***

The publication of Darwin's book on the descent of man aroused at once great interest and furious hatred, of which Timiryazev wrote: "In 1871, *The Descent of Man* appeared, and served as a signal for a fresh outburst of indignation on the part of hypocrites and reactionaries of all shades against its author. . . ." And further: "Science cannot reconcile itself to the idea that the development of mankind can at any time be held back by the regulations that dogma and myth impose on spheres into which science has not yet had time to penetrate."

* Notebook of 1837, *The Life and Letters of Charles Darwin*, Vol. II, London, 1887, p. 6.

** Charles Darwin, *The Descent of Man*, New York, MCMI, Vol. 3, Ch. XXI, p. 781.

*** Charles Darwin, *On the Origin of Species*, London 1950, Ch. XIV, p. 414.

Darwin could not have found the right approach to the solution of the problem of anthropogenesis if, in the preceding historical stages of science, sufficient facts had not been accumulated. Somewhat before Darwin's time there appeared basic works on this problem by Thomas Huxley (1825-1895) and Ernst Haeckel. Of the greatest value to Darwin was the work of Huxley (1864), his true ally in the struggle for the idea of evolution, especially in its application to anthropogenesis.

Approximately at the same time there appeared the works of the prominent French anatomist and anthropologist, Paul Broca (1824-1880), on the comparative anatomy of the Primates and anthropogenesis.

3. DARWIN'S GENEALOGY OF MAN

Darwin took some of his proofs of the natural origin of man from geology, using its evidence of the history of the Earth and the development of life. In this field the works of Charles Lyell were of great importance, although Lyell did not for a long time acknowledge the great antiquity of man. As far as ancient man is concerned, anthropology in Darwin's time already had at its disposal certain fossil remains. They were: a skull from Gibraltar (1848), a cranium from Neanderthal (1856) and a mandible from La Nolette (1866). The morphological peculiarities of these fossils showed the existence of a special group of ancient people with bodies of primitive structure.

Of no less importance were numerous archaeological discoveries of stone implements made about that time, the extreme antiquity of which was proved in France by Jacques Boucher de Perthes (1788-1858). These finds seriously undermined the position of the creationists who would not concede that man's antiquity on Earth was more than six to seven thousand years.

Darwin drew other proofs from comparative anatomy and comparative physiology that enabled scientists to understand the points of similarity and difference in organisms by their form, structure, function and development. Embryology provided him with some important facts showing similarities between man and the animals. He also had recourse to systematics, classifying all modern and fossil creatures according to degrees of similarity and establishing the presence or absence of relationship between the different groups. This latter is made possible by palaeontology, the study of fossil animal and plant life, their distribution and development.

The facts provided by these branches of science together with those of zoology, parasitology, pathology and psychology, when grouped together by Darwin, enabled him to assert with confidence that the immediate ancestors of man were the fossil apes of the Tertiary Period living in the tropical regions of the Old World. "The Simiidae then branched off into two great stems," wrote Darwin, "the New World and Old

World monkeys; and from the latter, at a remote period, Man, the wonder and glory of the Universe, proceeded."*

According to Darwin our ancient ancestors, the primitive monkeys, lived gregariously in the trees, had pointed ears, were covered with hair and both sexes had beards. Later ancestors, said Darwin, were the anthropoid apes. Of those known to him he mentions the Dryopithecus. Owing to changes in their natural surroundings, mainly the thinning out of the forests, these ancestors of ours, the extinct anthropoid apes, had to change their way of life, leave the trees and live on the ground in the savannahs. They later began to inhabit absolutely open country.

These radical changes were bound to have their effect on methods of locomotion: the half-quadruped, half-biped gait gave way to purely biped locomotion. This, naturally, was a long process, but it had the important result of liberating the hands from their functions as supports for the heavy body during motion on the ground. Man could only have descended from an erectly walking animal whose hands were free and whose brain was highly organized. In the course of his development man came to take first place among all living things. Thanks to his outstanding mental abilities, said Darwin, our ancestor was able to set about the making of tools and to employ articulate speech; thus he gained power over nature.

Later scientific development confirmed the correctness of Darwin's thesis of the descent of man from the fossil anthropoid apes. These, however, were only the immediate ancestors of man. As we go further and further back man's ancestors were the lower monkeys, the lemurs, the lower Placentalia, the primitive marsupial animals, reptiles, amphibians, the dipnoan or lungfish, the ganoid fish, primitive chordates like the lancelet (Amphioxus lanceolatus) and, finally, the common invertebrate ancestor of the lancelets and the ascidians. At the bottom of the ladder of animal life stand the first living beings and they are, therefore, the starting-point of man's development. The human egg cell is, to a certain extent, a recapitulation of the earliest phylogenic stage.

During man's ontogenic development he seems to repeat in brief the history of his ancestors' development. As early as 1844, Darwin made a number of profound observations on the connection between ontogeny and phylogeny: we see in them an anticipation of the Müller-Haeckel law.

Darwin regarded embryological data as being of great importance in the selection of proofs of man's descent from the animals and in delineating man's genealogy. He gave credit to the work done by A. O. Kovalevsky (1840-1901) on the embryonic development of tunicates and ascidians, on the structure of adult specimens of Hemichordata (Balanglossus) with their rudimentary notochord and also on the embryonic de-

* Charles Darwin, *The Descent of Man*, Vol. II, Chap. VI, New York, MCMIX, pp. 220-221.

velopment of lower Chordata (lancelet). These researches threw light on the origin of Chordata and on problems of the relation between invertebrates and vertebrates.

The intricate problem of the relation of ontogeny to phylogeny, of recapitulations and their disruptions, was dealt with specifically by D. I. Pisarev who, in 1864, gave a precise account of these phenomena. That same year the problem was analysed in its essential details by the German scientist Fritz Müller (1821-1897).

Another German scientist and prominent follower of Darwin, Ernst Haeckel, developed the problem and formulated it in 1866 as a "general biogenic law." Haeckel said: "Ontogeny is a brief and rapid recapitulation of phylogeny caused by the physiological functions of heredity (reproduction) and adaptation (nutrition). An organic individual repeats in the short and rapid course of its development the most important of those changes of form through which its ancestors passed in the slow and lengthy course of their palaeontological development following the laws of heredity and adaptation."*

A. N. Severtsov (1866-1936), an eminent Russian biologist, showed that the development of the embryo of a modern vertebrate does not so much indicate what the adult forms of the vertebrate ancestors were, as it does their embryonic forms, since many of the significant hereditary changes in the structure of the body take place during embryonic development and are reflected in the structure of adult forms in successive generations.

There is no doubt, however, that the study of embryonic forms also enables us to estimate a number of peculiarities in the structure of adult ancestral forms, especially in view of the fact that the reproduction and transmission of features occur in adult and not in embryonic forms.

The ontogeny of the human body begins with the female egg cell. This egg cell, fertilized by the male sperm and attaching itself to the wall of the uterus, is the early human embryo. Here the process of cell division begun in the Fallopian tube (where fertilization usually takes place) continues.

The process of cell division in the first stages of embryonic development resembles the process by which multicellular organisms developed from unicellular, probably in the Proterozoic Era; in the strata of the Earth's crust deposited towards the end of that era (about 500,000,000 years ago) scientists find the remains of the chief classes of invertebrates.

The early stages of embryonic development in monkeys are better known than those of man; Adolf Schultz discovered (1932) macaque embryos at a stage when they contained only a few cells and was able to observe their cleavage as far as the eight blastomere stage (fig. 1).

* Quotation translated from Ernst Haeckel, *Generelle Morphologie der Organismen*, Berlin 1866, II Band, S. 300.

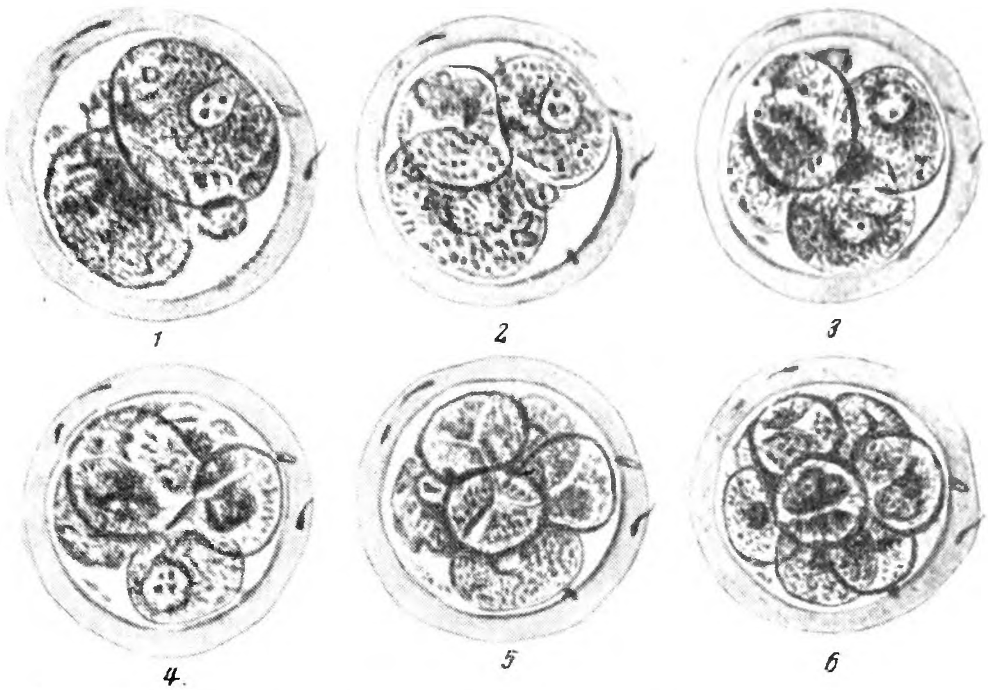


Fig. 1. Cleavage of fertilized egg cell (ovum) of rhesus monkey, from stage of two (*1*) to eight (*6*) blastomeres.
After A. Schultz, 1932.

The first stages of division of the human egg cell have become known only recently: in 1954, Hertig, Rock, Adams and Milligan (U.S.A.) studied four egg cells of 2, 12, 58 and 99 blastomeres. At five or six days the human embryo already possesses mesodermal segments. Segmentation in the structure of the muscular system of the human embryo is evidence of a protochordata stage from which evolved, for example, the notochord, primordial vestiges of kidneys (ventral kidneys) and traces of the caudal gut.

At the age of a few weeks the human and other mammal embryos display some resemblance to fish. Gill slits appear at the sides of the head and neck divisions. The vascular system resembles that typical of fish; the heart has two chambers, there is a caudal artery and blood vessels in the form of six arches of the aorta which lead to the gill arches. To this must be added the general shape of the embryonic body, the tail, gill slits and the chorda dorsalis.

This all goes to show that there were fish amongst the earliest ancestors of man and other higher mammals. Some of the specific features of the "fish stage" of development may appear in man as atavisms—for example fistula in the neck connected with the larynx.

At this early stage, man's brain has a very primitive structure, but, like those of all mammals, it already has three primordial capsules—fore, mid and hind.

The fore capsule forms the olfactory lobes and behind them is the fore-brain (prosencephalon) with its two cerebral hemispheres (telencephalon) each with a cavity, the first and second ventricles, and still farther back are the inter-brain (diencephalon) also with a cavity, the third ventricle, and the epiphysis and hypophysis.

The mid-capsule develops into the mid-brain (mesencephalon) with the quadrigeminal bodies on its superior surface. The channel within the mid-brain, the aqueductus cerebri, connects with the fourth ventricle formed in the hind-brain and with the medulla oblongata. From the lower part of the mid-capsule stem the pedicles of the cerebrum which, together with its hemispheres, develops out of the fore and mid divisions. The hind-capsule provides the pons, cerebellum and medulla oblongata (in which there is the fourth ventricle) making up the hind-brain (rhombencephalon). The medulla oblongata or myelencephalon is continuous with the spinal cord and the fourth ventricle with the cerebrospinal canal.

The brain of the fish has a more primitive structure than that of any other living vertebrate. The cerebral hemispheres are very small and have minute olfactory lobes. There are practically no transverse bonds between the hemispheres; these bonds develop in Amphibia and Reptilia, and, as the brain grows more complicated, are typical for the majority of mammals, the most highly organized vertebrates.

The mid-brain of the fish consists mainly of the optic bigemina (corpora bigemina) and is the biggest part of the brain (8 or 9 times the size of the cerebral hemispheres). The inter-brain (diencephalon) between the cerebrum and the mid-brain carries two outgrowths, the epiphysis above and the hypophysis below.

The epiphysis is an organ phylogenically connected with another organ, the parietal eye. The latter is capable of distinguishing light rays and develops in some modern vertebrates as an unpaired organ. It is met with among the Cyclostomata (in the lamprey) and among the Reptilia (in the Sphenodon, Phrynocephalus and Varanus). The opening of the parietal eye is found in the skulls of the majority of the most ancient fossil fish, amphibians and reptiles. From this we may assume that it was developed in our distant ancestors, the lower vertebrates.

The hypophysis is of still greater interest. Judging by the structure of this organ in the Cyclostomata (specifically in the Myxine, where the tube of the hypophysis ends in an exterior opening in the head, in front of the eyes, and has its other, interior end connected with the gut), it is also of very ancient origin. The hypophysis is closely related to the cranial section of the alimentary canal (including the mouth) and the system of gills: its anterior part is a derivative of an outgrowth of the primordial oral cavity. The posterior part of the hypophysis is formed from the lower, constricted end of the funnel of the inter-brain.

The hypophysis and epiphysis were formerly regarded as the most mysterious organs. In his day, Descartes even believed the epiphysis

to contain the soul. There is, however, nothing mysterious in them: they are very ancient organs that have undergone extensive transformation and are now endocrine glands. The peculiarities of their development in man are evidence of his kinship with the lowest vertebrates. In some adults an open hypophysis reaches the mucous membrane of the pharynx ceiling where supplementary hypophyses are sometimes found. In three to five per cent of all cases there is a craniopharyngeal duct in the form of a rudimentary tube for the stem of the hypophysis in the parietal bone of the skull (this duct is more frequently met with in the skulls of chimpanzees).

The epiphysis in the human embryo develops (as in other modern vertebrates) behind the parietal organ with which it has some connection not fully explained. The Russian zoologist and anatomist, V. M. Shimkevich, thought that these two organs might possibly be vestiges of two paired formations connected with the development of the organs of vision in the lower vertebrates, our distant ancestors.

What has man inherited from the amphibian stage? Some scholars are of the opinion that the natatorial web between the fingers of the human embryo belongs to this stage. The tendons of the musculi recti in the lower part of the stomach wall have been inherited from the amphibians.

Man also got the ischiadic artery, part of the inferior glutaeal artery, from the amphibians. Cases of a free central bone in the wrist skeleton of an adult man may possibly be regarded as one of the examples of a part return to a structural form typical of our amphibian ancestors. In man's olfactory organ there is a diverticulum inherited from his amphibian ancestors—Jacobson's organ. In the foetus it develops in the fifth month in the form of a duct connecting the nasal and oral cavities. Although this organ is reduced before parturition, it is to be found in adult man in the form of a short, blind duct to which are attached the ends of special nerves. Jacobson's organ is highly developed in ruminants.

Lastly, man also inherited from the ancient amphibians their nictitating membrane in the form of the caruncle (caruncula lacrimalis), a fold in the skin near the eye. This fold in the human eye corresponds to the nictitating membrane found in modern amphibians, reptiles, birds and some fishes.

In most mammals the nictitating membrane has been greatly reduced, especially in the whales (Cetacea) and the majority of the Primates, but it is still highly developed in others, for example in rabbits, cats and certain monkeys. The fold in man is a good example of a rudiment.

Man has also inherited some features from his reptilian ancestors that are most easily detected in the foetus at the age of a few months—in the development of the brain, in the structure and character of limb articulation with the body.

In the embryo, furthermore, Meckel's cartilage forms part of the first gill arch that later develops into the lower jaw or mandible. As in all

other mammals this cartilage then becomes two auditory bones, the hammer (malleus) and the anvil (incus). In our ancestors it underwent a process of ossification and formed a connecting link in the intricate mechanism joining the mandible to the skull, as in the case of modern reptiles. The third auditory bone, the stirrup (stapes) develops from the hyoid gill arch and is found in one form or another in Amphibia and Reptilia.

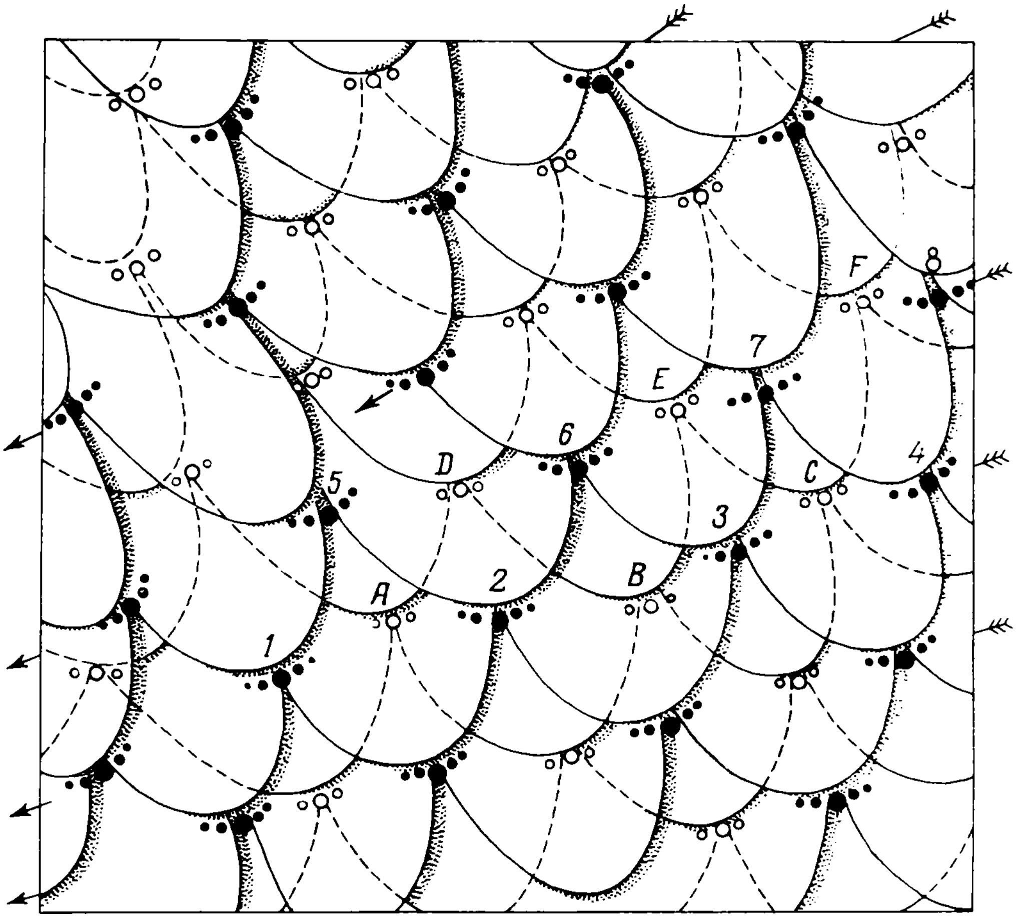


Fig. 2. Arrangement of rudimentary hair groups on trunk of human foetus; reproduction of epidermic scales at four months—groups of three and five hairs are visible.
Greatly magnified. After F. Stöhr, 1907 (from M. Weber, 1936).

The way in which the hairs are distributed in groups of three and five (fig. 2) on the body of the foetus to a certain extent corresponds to the arrangement of the scales on the hide of the ancient reptiles that were the ancestors of the mammals.

Lastly, there is a physiological peculiarity in the regulation of body temperature in newborn infants (and in children even up to five years of age) that is probably due to our ancestors having evolved from animals

of a transitional type between reptiles and mammals that possessed only a rudimentary neurovascular mechanism regulating the development and distribution of heat energy in the body (Slonim, 1952).

A large number of facts go to prove that among man's later ancestors were the extinct mammals. The human foetus at the early stages of its development is lissencephalic, the brain having a smooth surface and primitive structure closely resembling that of modern lower mammals (this peculiarity has probably been inherited from a Mesozoic form).

There are other primitive features shown in man's ontogeny that bear evidence of his kinship with the lower mammals. The six-week human embryo has several pairs of primordial mammary glands, transitory along the mammary ridge. Rather thick but short hairy down (lanugo)

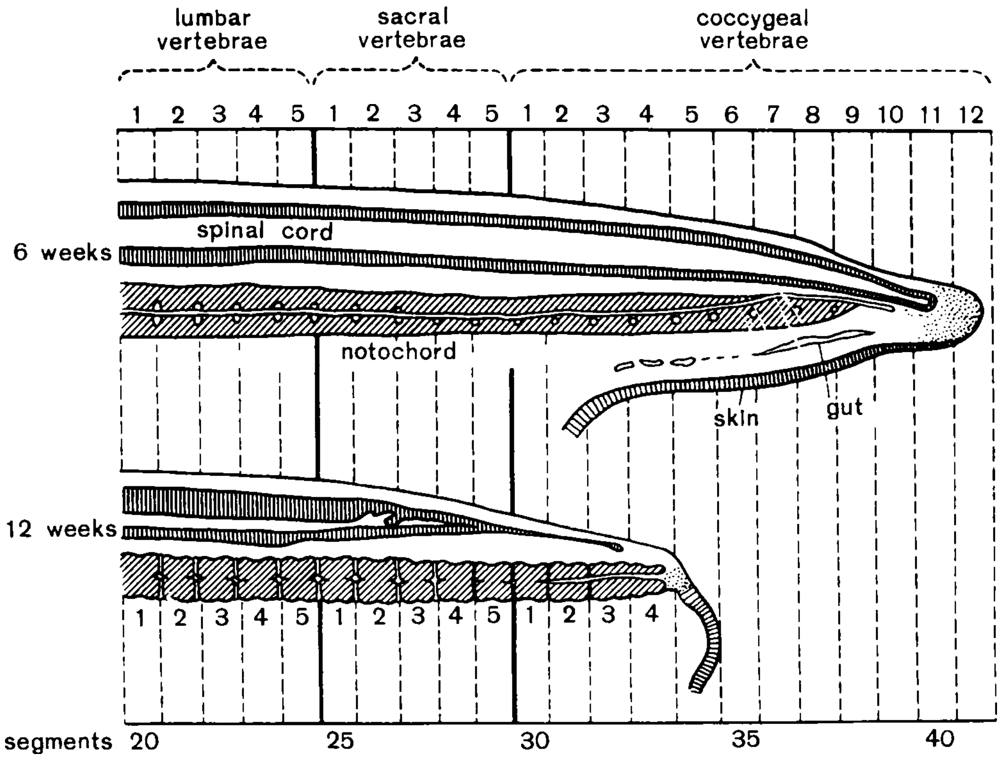


Fig. 3. Coccygeal region and its reduction at early stages of embryonic development (6 to 12 weeks). Greatly magnified.
After Kunitomo from A. Keith, 1933.

covers the whole body, with the exception of the palms of the hands and the soles of the feet. Ridges of noticeable size on the soft palate are similar to those that in their developed form are typical of monkeys, the Carnivora and other mammals.

In the embryo between six and twelve weeks the caudal region is well expressed in which the end of an embryonic spine with eight or nine vertebrae is to be seen (fig. 3). At the end of this period the exterior division

of the tail is reduced and withdrawn. The interior division of the caudal region retains from two to six vertebrae, the coccygeal vertebrae, that usually join together to form the coccyx which in young men and women does not, as a rule, fuse with the sacrum.

These last three features, preserved by way of exception and developing in certain individuals, as well as several others inherited from our ancestors, appear only as atavisms. Another of them, for example, is the absence of the fold on the helix of the ear lobe on many human foetuses. In some adults the pointed shape of the ear, known as macacus-ear, is retained. This form of the ear lobe is present in the human foetus at the age of five or six months and is, apparently, inherited from fossil lower monkeys that are in some respects similar to the macaque and form one of the ancient links in our genealogy. In cases where the helix is incomplete on the upper and outer parts of the lobe, the skin forms into a slight prominence known as the Darwinian tubercle.

Among the atavistic features that belong to the mammal stage we must include: strongly developed ear muscles that permit a man to move the lobes of his ears; the development of laryngeal ventricles in the thorax to a depth of more than a centimetre; supernumery mammary glands or nipples; vestiges of several surplus teeth; excessive hairness of the body and face; an embryonic tail (Gregory, 1936; Nesturkh, 1936).

Every human being possesses a vermiform appendix; this rudimentary organ is indisputable evidence of the fact that our ancestors at the lower mammal stage possessed a fairly long caecum, or blind gut. In some of the modern mammals, the rodents and ungulates, for example, energetic digestive processes take place in the caecum.

The vermiform appendix is only one of the rudimentary organs of the human body. It is typical of these rudiments or vestigial organs that they vary to a very great degree in shape, size and structure. The human appendix has an average length of eight or nine centimetres, but sometimes it is as long as twenty or twenty-five centimetres, as it is in the anthropoids; it may also be greatly reduced to no more than one or two centimetres; in very rare cases it is completely absent.

The vermiform appendix is very rich in lymphoid tissue, especially in young individuals, and apparently corresponds to some division of the blind gut in other mammals that have no appendix; it may possibly fulfil some function as yet unknown.

We may assume that man's ancestors, in the course of evolution, lost the following characteristics either fully or in part: a keen sense of smell, a hairy covering on the body, the majority of the dermal muscles, the tail, prehensile feet, mandibular and intestinal structures indicating a herbivorous nature, laryngeal sacs, the two-horned uterus (uterus bicornis) and pointed ear lobes. The females of man's later ancestors, the monkeys and lemurs, had most of their mammary glands reduced because of their bearing fewer offspring; Darwin believed that this was transmitted to the males of these animals.

In the first days of its life the newborn infant's hands are extremely prehensile (fig. 4). This is an indirect proof of man's descent from an arboreal animal, i.e., of the simian stage in man's genealogy.

Fig. 4. Prehensility of hands of newborn infants. After L. Robinson, 1891.

Evidence drawn from comparative pathology and parasitology was regarded by Darwin as being of great importance in proving man's relationship to the animals. We cite one confirmation of Darwin's theory provided by modern parasitology. Of the twenty-five Protozoa that are parasitic to monkeys, eighteen species are to be found in man, although they have not been recorded for other mammals.

On the eve of the publication of Darwin's book, Engels pointed to the great significance which the study of the physiology of man and animals has as a confirmation of the materialist view of man's place in nature and of his origin. In a letter to Marx he said: "So much is certain: comparative physiology gives one a withering contempt for the idealistic exaltation of man over the other animals. At every step one bumps up against the most complete uniformity of structure with the rest of the mammals, and in its main features this uniformity extends to all vertebrates and even—more hazily—to insects, crustaceans, tapeworms, etc. The Hegelian business of the qualitative leap in the quantitative series is also very fine here."*

Darwin paid special attention to the proof of the phylogenic identity of emotions and means of expressing them: he wrote a special paper on this subject which was closely connected with his *Descent of Man*. In the essay I refer to, *The Expression of the Emotions in Man and Animals*, published in 1872, he succeeded in showing that as far as the features of elementary psychic activity and means of expressing the emotions are concerned, man is undoubtedly genetically related to the monkeys.

* Marx-Engels, *Selected Correspondence*, Moscow 1955, No. 44, p. 132.

Another important Darwinian conclusion was that there are no psychic differences between the races of mankind.

Darwin's study of facts of this kind, together with the rudiments and atavisms, served to convince him that man has a long genealogy reaching far back into the history of the animal kingdom, and that the last link that preceded the first men consisted of fossil anthropoids.

In determining the pre-human stages of man's genealogy Darwin had only the scanty remains of the bones of fossil mammals (down to fossil monkeys) to go on. Nevertheless, he was fairly accurate in establishing the main stages in the evolution of our nearest ancestors, the lemurs and monkeys. He also outlined the main features of development of man's erect posture which he found in the Upper Tertiary fossil apes that were our immediate ancestors.

In discussing the causes that led to the erect mode of locomotion, Darwin assumed that a change of feeding was of great importance; this occurred when our ancestors began to spend more time on the ground in search of food. But, says Darwin, there were probably other causes that led them to change their arboreal way of life for a terrestrial one and begin walking on two legs in open country.

The development from ape to man was, said Darwin, made easier by a number of specific features, such as the highly developed brain and the differentiated fore and hind limbs (the former had already become specialized organs for hanging from branches, and for the prehension of fruits and other objects; the latter served primarily as supports). Erect gait, high mental development and the gregarious instinct were a great help in the invention of tools, the appearance of articulate speech and of methods of fire making, all of which, in the course of his further development, raised man far above the other animals.

Darwin believed that our ancestors descended from the trees to the ground in the struggle for existence and were compelled to move either on four legs (as did the ancestors of the baboons) or on two. In connection with this it is interesting to cite the opinion of Sir Arthur Keith: he thinks it possible that our arboreal ancestors developed a type of locomotion that required them to place the soles of their feet on the thick, horizontally growing lower limbs of a tree and grasp the upper branches with their hands. Such a mode of locomotion could change our ancestors into bipeds when they began to move on the ground. This mode of locomotion on branches was given the name of cruriation, at Keith's suggestion.

Only man became a biped, wrote Darwin; to a very considerable extent he owes this to the hands and feet of his ancestors, the apes, in whom they developed in different directions while they were still living in the trees. Erect locomotion inevitably accelerated the process of differentiation converting the foot of the ape with its partially grasping and partially supporting functions into the human foot that is used exclusively as a support.

What were the biological factors that assisted in the transition from ape to man? According to Darwin the chief factors were: natural selection, the influence of use and disuse, sexual selection; to these he added mutation, environmental influences, reproduction, heredity, correlative changes and other factors then not discovered. As a biologist Darwin was best able to explain the origin of man from the standpoint of biological laws and he exaggerated their role and significance. It is true that he stressed the tremendous difference between man and even the anthropoids. Nevertheless, he was unable to offer a precise concept of the process of anthropogenesis which differed sharply from the biological evolution of monkeys and all other animals. Darwin treated this process as that of the gradual transformation of the ape into man and did not draw a sufficiently sharp line between the ancient ape and the first man that is marked by the appearance of the earliest forms of work.

Darwin made an attempt to introduce points of a social character for the explanation of man's evolution. He gave a prominent place, for example, to an analysis of the influence of man's social habits on the development of moral qualities, the sense of duty and many other of man's distinguishing features. Darwin, however, was hampered by the bourgeois conception of social development and could not correctly assess the influence of social factors; he was a long way off the labour theory of anthropogenesis. The obvious defects in Darwin's solution of the problem of anthropogenesis do not in any way detract from the tremendous significance of his two classic books on this problem.

Darwin drew a general picture of the extremely long genealogy of man, the last link of which was formed by the highly developed fossil anthropoid apes of the Upper Tertiary Period. An acquaintance with their present-day relatives will enable us to get a mental picture of these fossil apes, get an idea of their structure and biological peculiarities and of their way of life, their food and mode of locomotion. In this way it is easier to determine who man's immediate ancestors were. At the same time an answer may be found to the question why man evolved from only one species of anthropoid ape while hundreds of other species were unable to become men.

C H A P T E R T W O

THE ANTHROPOID APES AND THEIR ORIGIN

1. LIVING ANTHROPOIDS

By the structure of his body man belongs to the class of Mammalia which contains about 3,750 species. Man possesses the chief characteristics of all mammals, such as mammary glands, a coating of hair and a constant body temperature.

The class of Mammalia is divided into three subclasses: 1) oviparous (platypus, echidna), 2) marsupial (kangaroo, opossum) and 3) placental (dog, horse, mouse, mole, elephant, monkey). The third subclass, the biggest of the three, consists of mammals, the females of which during parturition eject the afterbirth, consisting of the placenta proper with the umbilical cord and the amniotic (amnion) and villiferous (chorion) sacs. Man belongs to this latter subclass and is placed amongst the Primates. The order of Primates was fixed by Linnaeus in 1735 and today includes man, the Old World and New World monkeys, the tarsiers and the lemurs (prosimians). Some zoologists and anthropologists are of the opinion that the tree-shrews (Tupaiae) should be included among the Primates and excluded from the Insectivora (fig. 5).

The following are the characteristic features of the majority of the Primates: a relatively large brain with prominent temporal lobes, less developed olfactory and more advanced optic lobes, and several special furrows (for example, the calcarine fissure in the occipital lobe); five digits suitable for grasping on the hands and feet, with nails in place of claws and the thumb and big toe opposable to the other digits; a clavicle; semi-circular bones protecting the sides of the orbits; teeth of different types; a stomach of simple form; only one pair of mammary glands in the thorax. Primates bear one (rarely two or three) young. They live mostly in trees and their mode of locomotion is climbing, running and hopping on the branches. Their food is mainly vegetable, although many include insects and other small animals in their diet. The adaptation of the Primates to life in the trees brought about many of the anatomical features that are peculiar to them.

Tree-shrew
(Tupaia)

Lemur

Tarsier

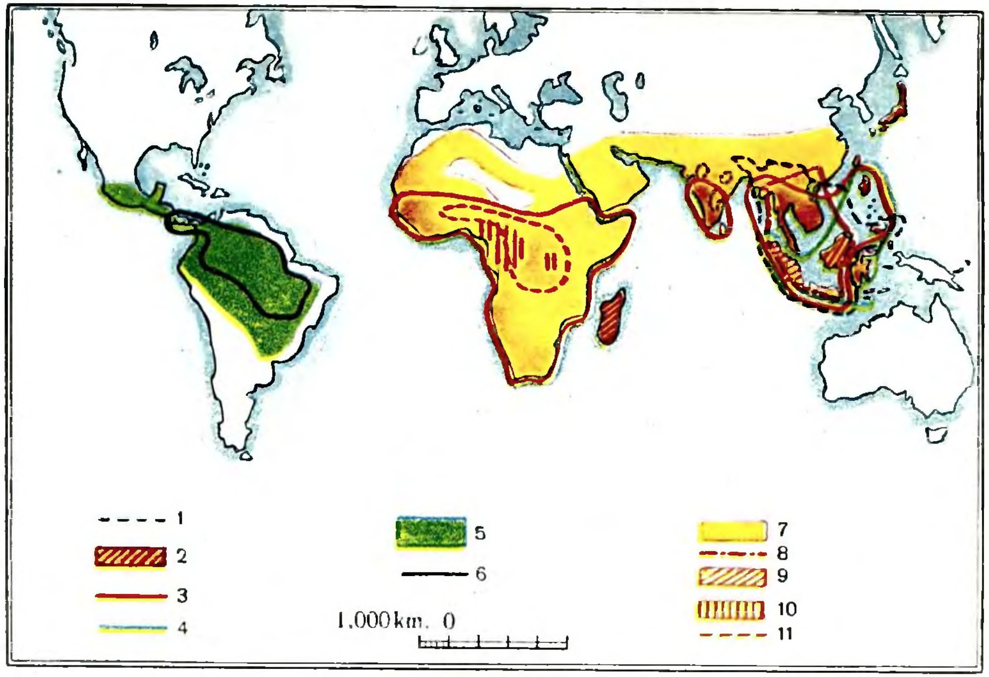


Fig. 5. Distribution of Primates. (From album *Origin of Man*, M. Plisetsky, 1951.)

1—tupaias; *2*—Madagascar lemurs; *3*—African and Asian lemurs; *4*—tarsiers; *5*—capuchins and related monkeys; *6*—marmosets and tamarins; *7*—guenons, baboons and leaf-monkeys; *8*—gibbons and Siamangs; *9*—orangutans; *10*—gorillas; *11*—chimpanzees.

Chimpanzee

Gorilla

Orangutan

Cebus

Baboon

Semnopithecus

Gibbon

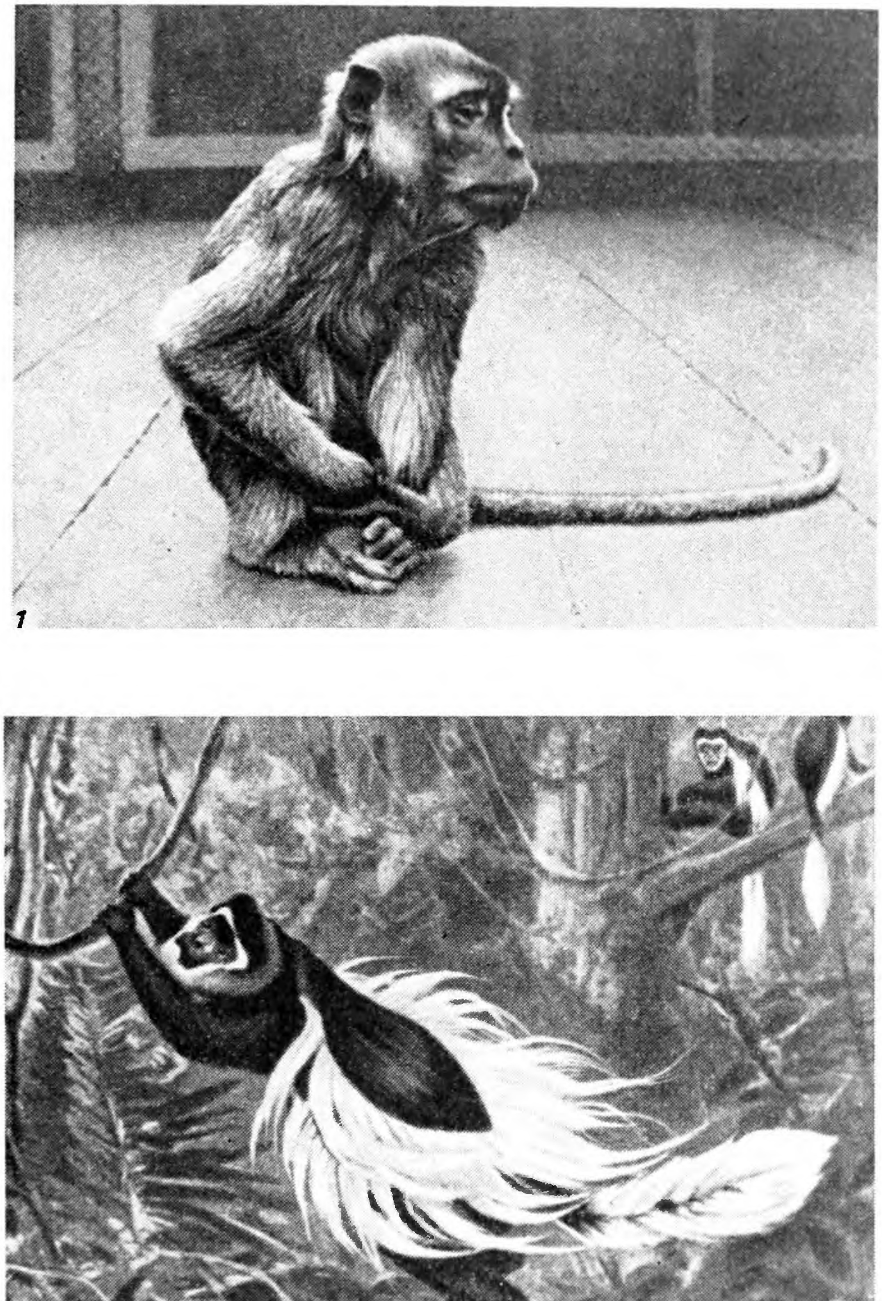


Fig. 6. Asian and African lower monkeys:
1—Javanese macaque (M. cynomolgus Anderson), habitat: Malay Archipelago: *2*—Ethiopian white-tailed guereza or Mbega (Colobus caudatus Thomas). Archives of Moscow Institute of Anthropology (*1*); and after L. Heck, from O. Abel, 1931 (*2*).

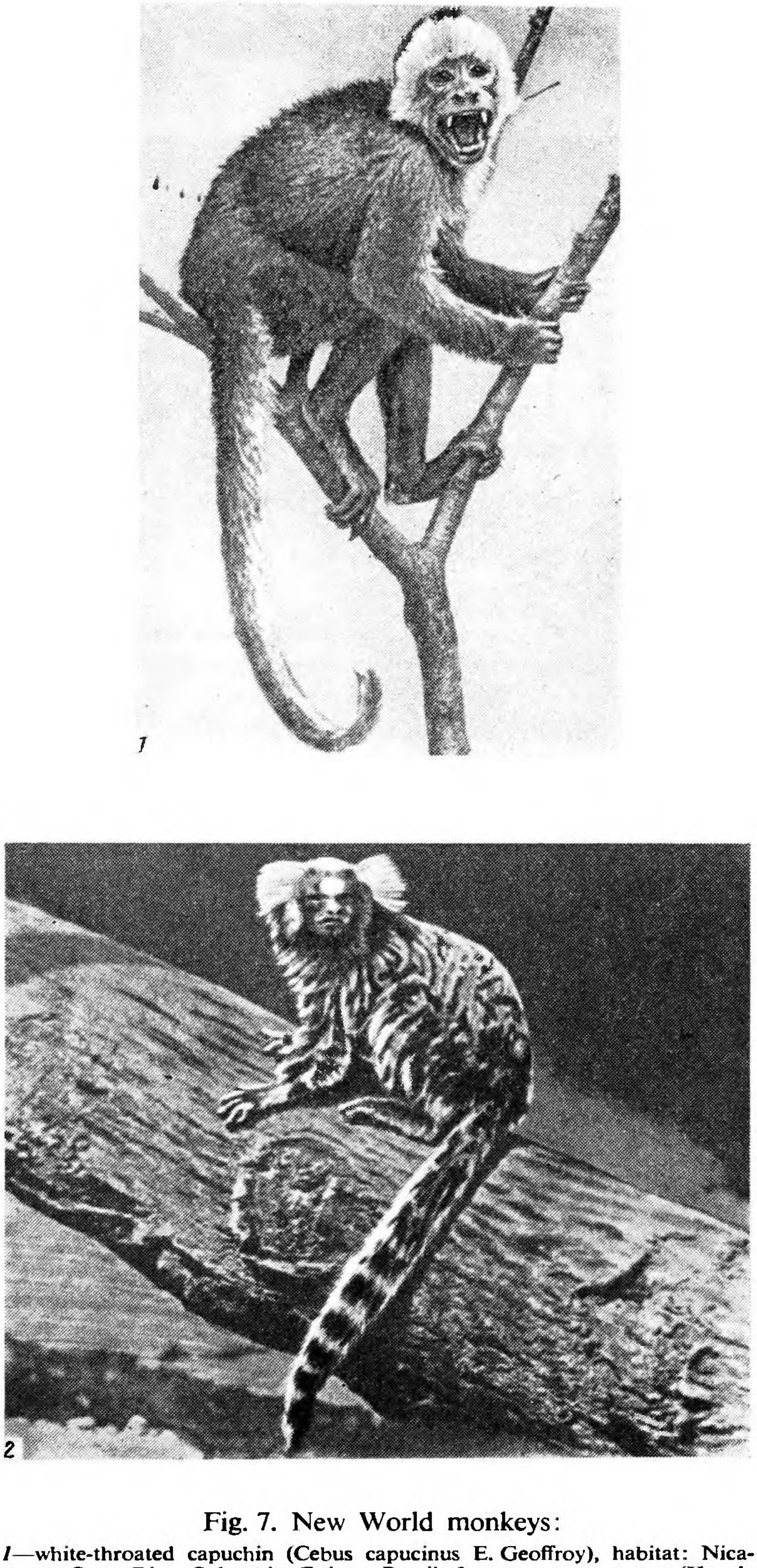


Fig. 7. New World monkeys:

1—white-throated capuchin (Cebus capucinus E. Geoffroy), habitat: Nicaragua, Costa Rica, Colombia, Guiana, Brazil; *2*—common marmoset (Hapale Jacchus L.), habitat: Eastern Brazil. After D. Elliot, 1912.

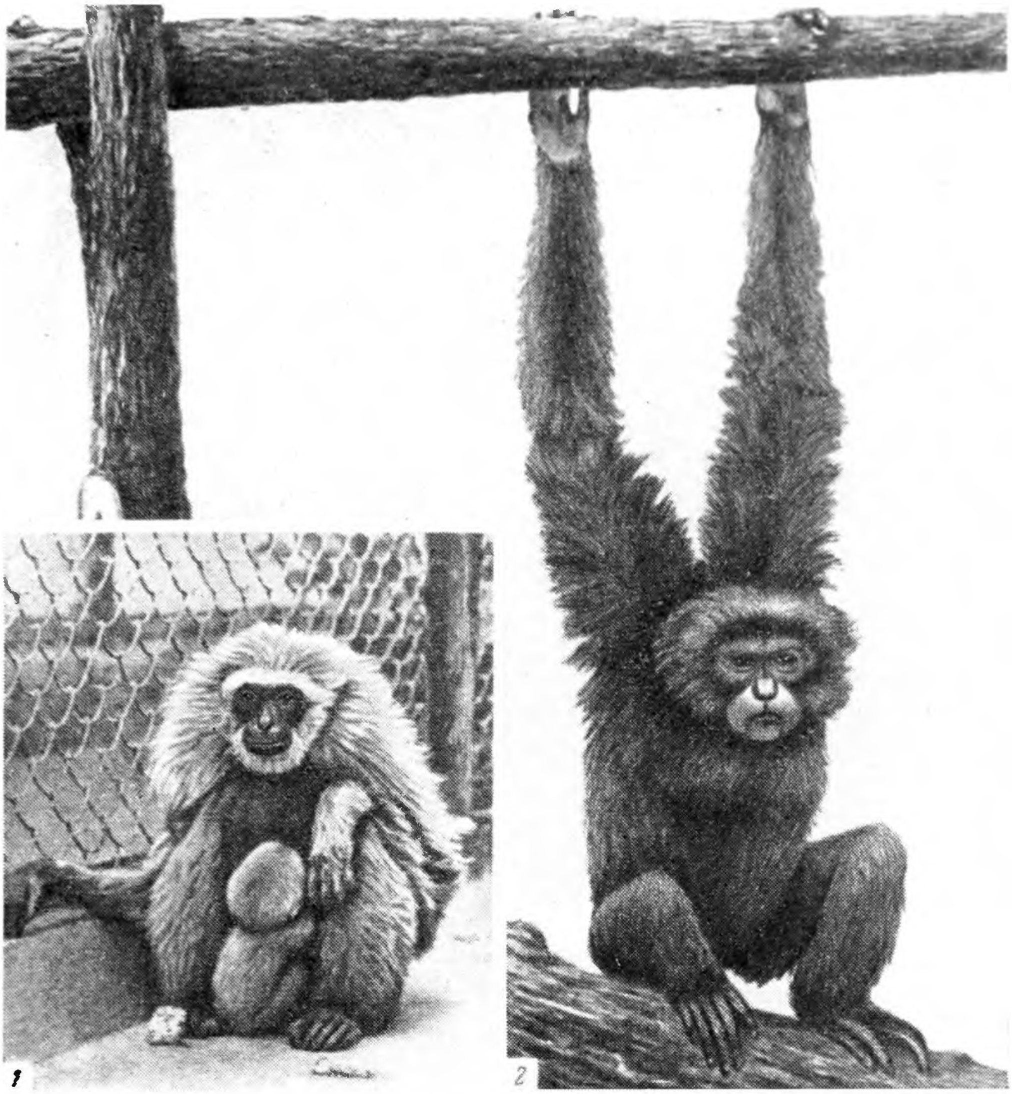


Fig. 8. Gibbons:

1—female Siamese gibbon (Hylobates concolor Schlegel) with her offspring, Primo, born at San Diego Zoological Gardens, U.S.A. in 1938; *2*—web-toed gibbon or Siamang (Symphalangus syndactylus F. Cuvier), habitat: Sumatra. After B. Benchley, 1944 (*1*) and after R. and A. Yerkes, 1934 (*2*).

If the Primates are classified according to the degree of their approximation to man the anthropoids come first, the lower catarrhines second (fig. 6), the American monkeys third (fig. 7), the tarsiers fourth, the lemurs fifth and the Tupaiidae last. One point of similarity between man and the Old World monkeys is the narrowness of the nasal septum or partition as compared with the monkeys of the New World that are sometimes called platyrrhine or broad-nosed to distinguish them from the catarrhine or narrow-nosed monkeys of Europe, Africa and Asia. There is a complex of features typical for man alone, the most important of which are: a very big and highly developed brain; a hand with a strongly developed and fully opposable thumb; ability to stand and move on two legs; a foot that rests firmly on the ground with a resilient longi-

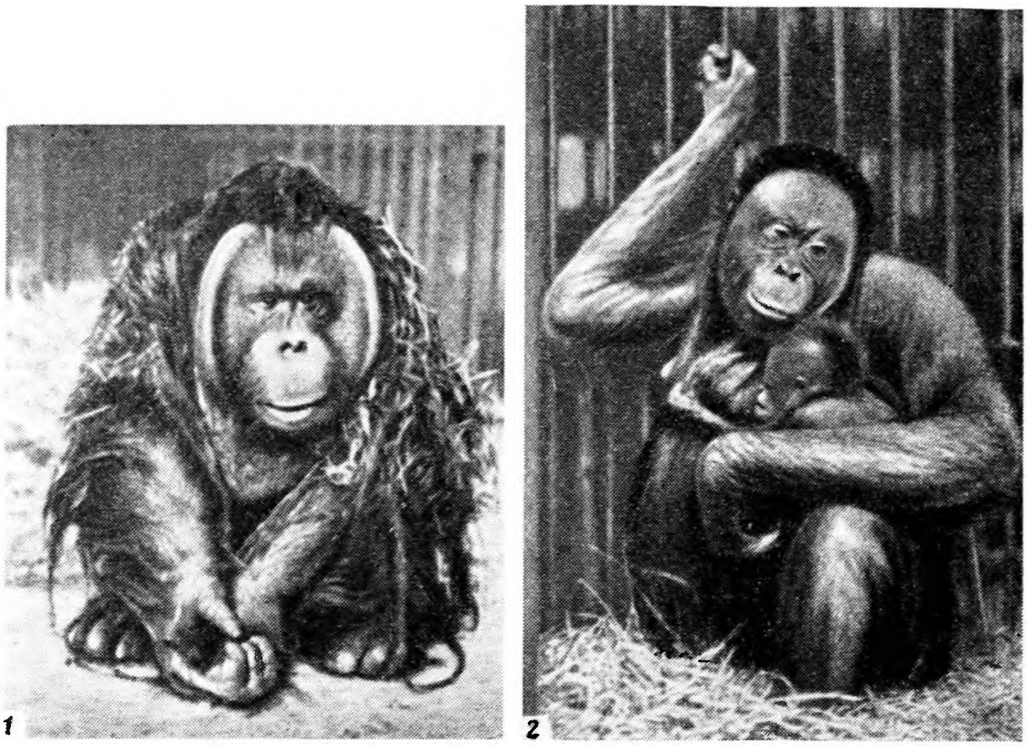


Fig. 9. Orangutans (Simia satyrus L.):
1—male; *2*—female with young; habitat: Sumatra and Borneo. After S. Zuckerman, 1933 (*1*) and after R. and A. Yerkes, 1934 (*2*).

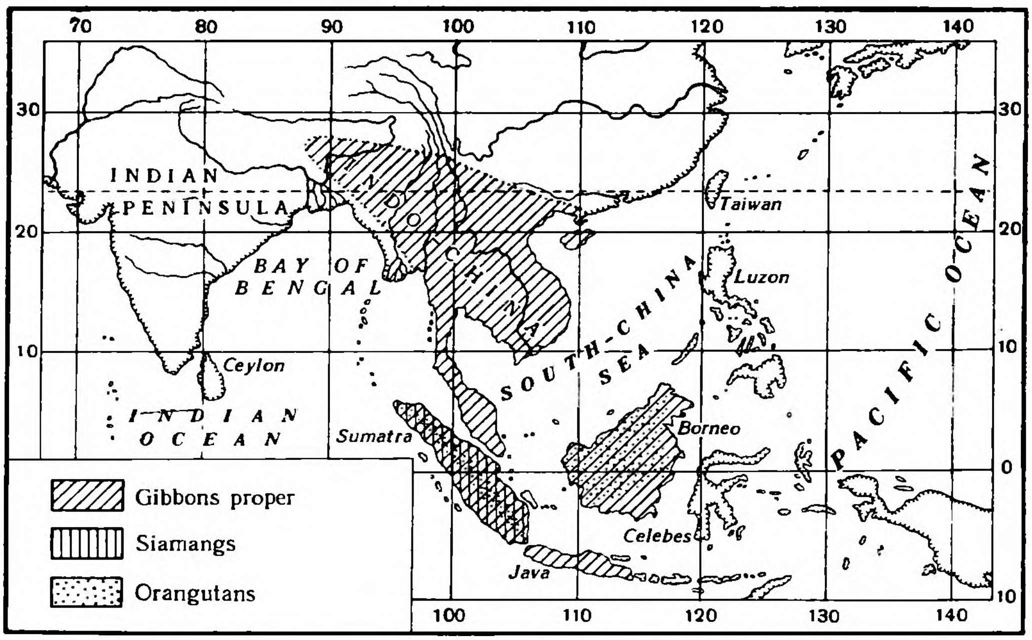


Fig. 10. Map of habitat of gibbons and orangutans.
After A. Brehm, 1920. (Slightly changed by author.)

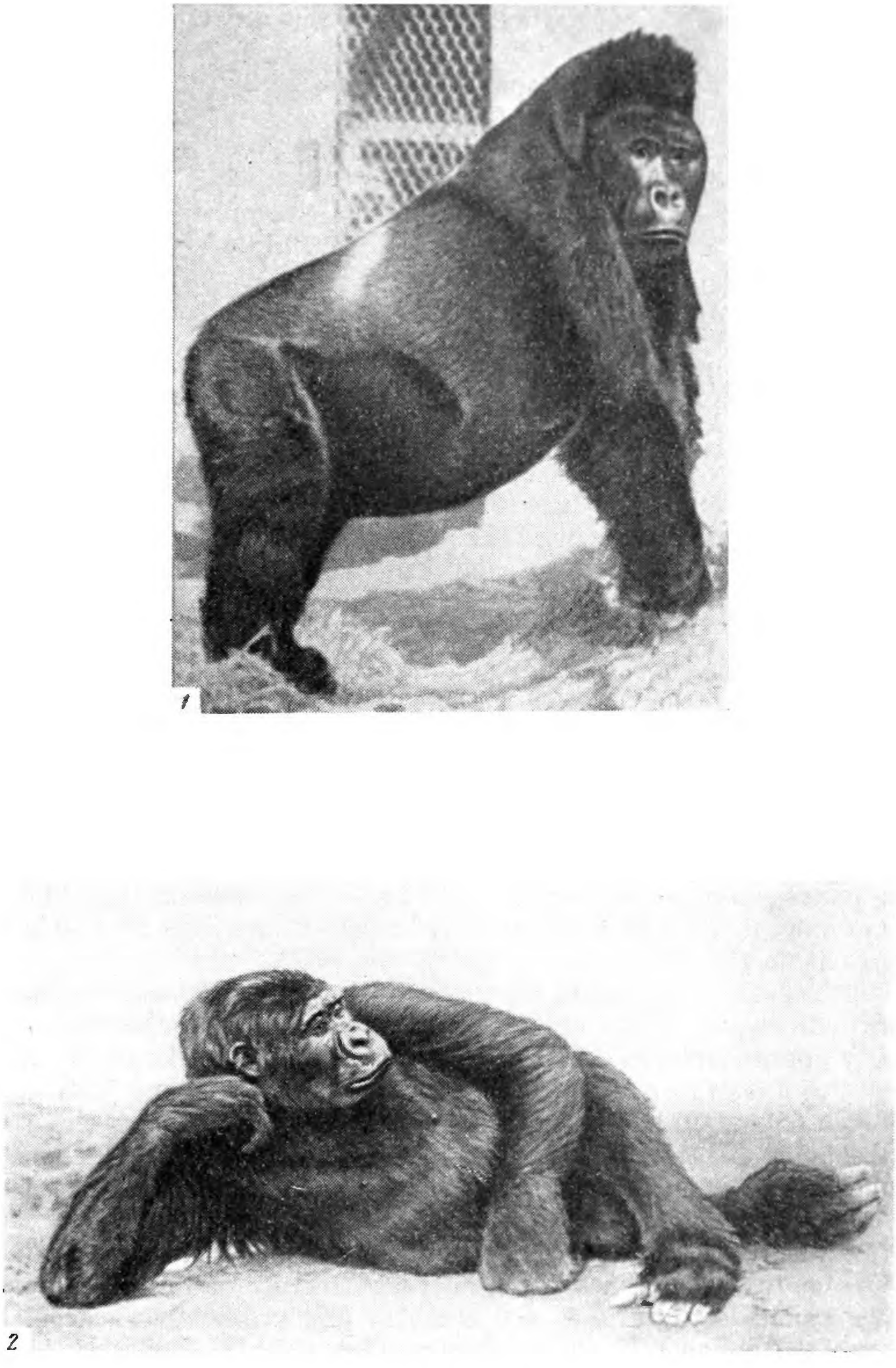


Fig. 11. Gorillas:

1—male mountain gorilla (Gorilla gorilla beringei Matschie), Mbongo, in San Diego Zoological Gardens, U.S.A. *2*—young female mountain gorilla, Miss Congo (Laboratory of Primate Biology, Florida). After B. Benchley, 1944 (*1*) after R. and A. Yerkes, 1934 (*2*).

tudinal arch and the big toe well developed but non-opposable to the others.

The family of anthropoid apes includes the gorilla, the chimpanzee, the orangutan and the gibbons (figs. 8-10). The gorilla and chimpanzee of Africa approximate most nearly to man. The Asian anthropoids are further removed, especially the gibbons, or "lesser apes." The gibbons are regarded as being a sort of transition stage from the lower cercopithecoid type of monkey to the higher anthropoids (Weber, 1936; Nesturkh, 1941).

All the anthropoids differ from the lower Old World monkeys such as the guenon, macaque, baboon and leaf-monkeys in several respects: they have no tail, no ischial callosities (except the gibbons) and no cheek pouches. Some lower monkeys have down and their hair is often thicker than that of the higher apes. The gibbons have no tails or cheek pouches but they have very thick hair and ischial callosities.

The gibbons fall far short of the other anthropoids in size, weight and in the development of the brain. The body of even the biggest gibbons is no more than a metre in length and their weight is under 18 kilograms. The brain weighs only 100 to 115 grams while that of the gorilla weighs 500 to 600 grams and in exceptional cases from 650 to 685 grams which is more than that of the chimpanzee or orangutan. The gorilla (fig. 11) has a longer body than the other anthropoids. Male gorillas reach a height of 180 centimetres, some individuals even 2 metres, and their weight varies from 200 to 300 kilograms.

Female gorillas are smaller and lighter like the female orangutan; male orangutans are as tall as 150 centimetres and weigh from 100 to 150 kilograms, in exceptional cases over 200 kilograms; male chimpanzees are lighter and although they are as tall as 150 centimetres their weight is not more than 60 or 70 kilograms (the females are from 5 to 10 kilograms lighter).

On the basis of these data we may call the gibbons the lesser or small apes to distinguish them from the big anthropoids or great apes that more nearly approximate man in height and weight. If we take the average height of a man to be between 165 and 170 centimetres and his weight between 65 and 70 kilograms, it is obvious that man is much closer to anthropoids of the chimpanzee (figs. 12 and 13) or gorilla type than to the gibbons. Furthermore, there is little difference in the height and weight of the two sexes of gibbons, whereas women, on the average, are 10 centimetres shorter and about 10 kilograms lighter than men.

One of the peculiarities of the internal structure of the anthropoids is the paired laryngeal sacs that are very highly developed (except in some of the gibbons). These sacs act as resonators for the sounds produced by the larynx. Many travellers have written of the power of the voices of the anthropoids, of the deafening screams emitted by herds of chimpanzees or gibbons in the tropical forests. Gorillas and orangutans also emit thunderous roars.

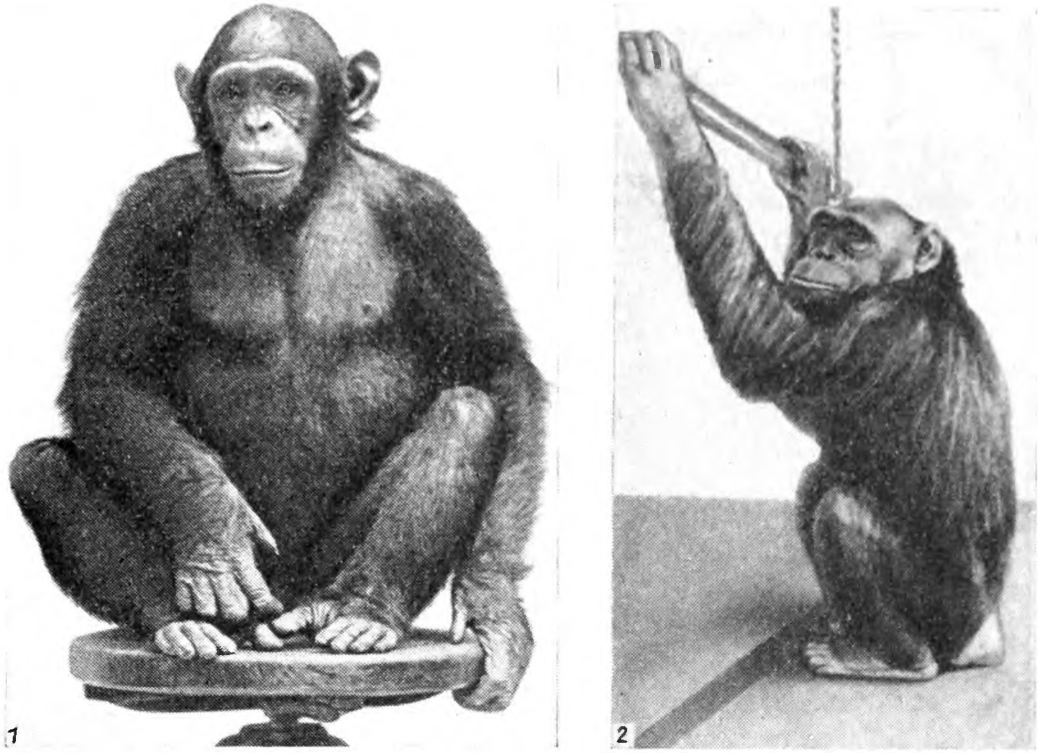


Fig. 12. Common Guineas chimpanzee (Pan chimpanse Meyer = Anthropopithecus troglodytes Flower and Lydekker):

1—male (New York Zoological Gardens), after J. Elliot, 1912; *2*—adult female, Bella, Moscow Zoological Gardens; habitat: Equatorial Africa.

The laryngeal sacs of the anthropoids correspond to the laryngeal ventricles in man that are situated in the throat immediately above the vocal chords proper; these tiny projections are rudimentary laryngeal sacs that functioned in the extinct anthropoids and are further evidence of man's genealogy. These sacs are not found in the lower catarrhine monkeys who have unpaired sacs of different origin.

Another peculiarity of internal structure is the vermiform appendix of the caecum: it is found in all anthropoids and is longer than that of man. Recent investigations show that the lower monkeys have no appendix. Here, again, man is closely related to the anthropoid apes.

Apart from the obvious and often astounding similarities between man and the anthropoid apes both in their external and internal structure, there are a number of very noticeable differences that to a great extent result from different modes of locomotion, the nature of the food and the way of life.

In short, the anthropoids are highly developed apes adapted for life in the dense tropical jungles. There they move from branch to branch and from tree to tree, often swinging (brachiating) from one limb to another using only their arms and with their legs drawn up under the

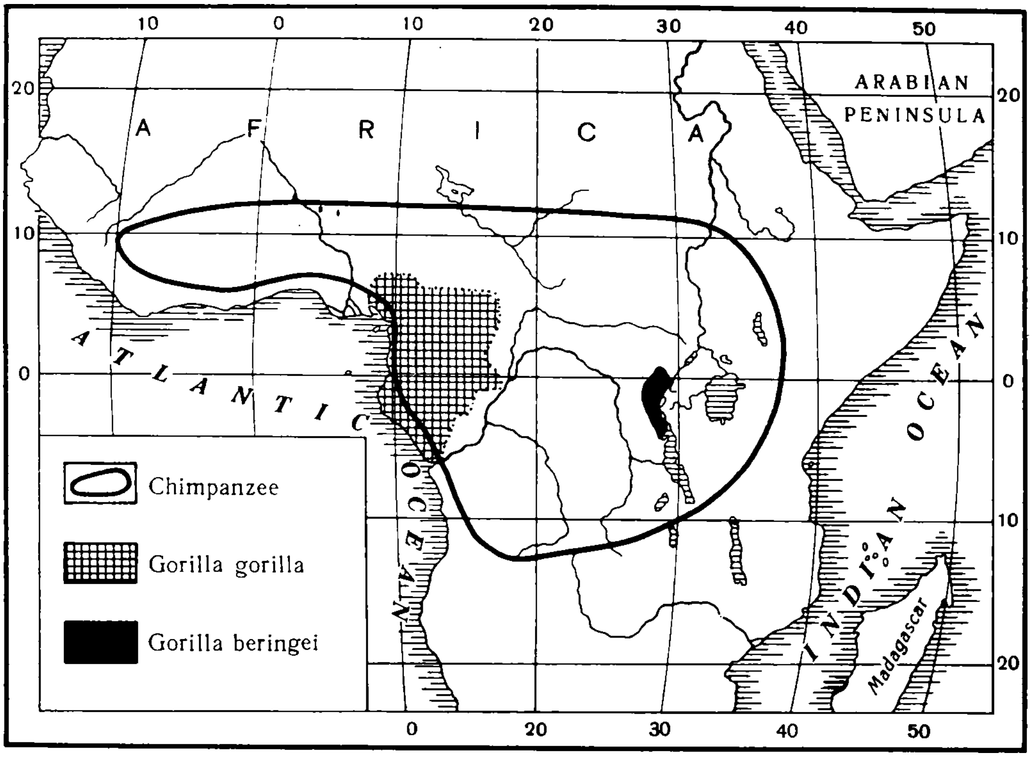


Fig. 13. Habitat of African anthropoids—chimpanzees (after A. Brehm, 1920, with author's additions) and gorillas (after H. Coolidge, 1929).

body. On the ground these apes move mostly on all fours with the body in a semi-erect position; the fore limbs or arms are longer than the hind limbs or legs since they use them more energetically as a means of locomotion in the trees (figs. 14 and 15).

Of the anthropoids only the gorilla lives mostly on the ground, but it has not lost some of its tree habits: in case of danger the gorilla takes to the trees and at sunset builds a fresh nest in a fork of the branches and covers it with soft leaves, grass and moss for a comfortable night's rest.

Chimpanzees and orangutans also build nests, the former making them on the ground to rest in for some hours during the day. The gibbons, unlike the other apes, do not build nests. If man's ancestors formerly possessed the instinct for building nests in trees or, like the chimpanzee, for making a daytime bed on the ground, not a trace of it has been retained by modern man even in his early childhood.

The big anthropoids eat fruit, leaves, flowers, shoots and other parts of plants. The gibbons also prefer vegetable food but manage to catch a butterfly or bird on the wing and are fond of robbing birds' nests of their eggs and young. The great apes can bite the biggest fruits with their powerful teeth: their jaws are very strong and those of the gorilla and orangutan are more massive and powerful than those of the smaller chimpanzee.

Fig. 14. Herd of white-handed gibbons (Hylobates lar).
Fresco by Y. Samoilenko-Mashkovtseva. Museum of Anthropology, Moscow State University.

Fig. 15. Orangutans (Simia satyrus), male and female.
Fresco by Y. Samoilenko-Mashkovtseva. Museum of Anthropology, Moscow State University.

The extensive anatomical differences between man and the anthropoids are to a considerable extent overshadowed by the many resemblances that testify to man's relationship with these apes. One has only to study the blood and its properties, the specific features of propagation and the course of development in the individual to become convinced of this. The leukocytes in the blood of the chimpanzee and gorilla are closest to those of man, the neutrophils and eosinophils having a similar type of nuclear segmentation; they have but few segments, those of the lower monkeys having considerably more.

Still more important is the biochemical affinity of the blood of man and the anthropoids. Examples of this affinity are the almost equal precipitation of albumin in experiments with serum and a similarity of blood groups. Apart from a large number of other, mostly secondary, isoserological factors, human beings have four main blood groups: I (or zero), II or A, III or B and IV or AB that form a single uniform system. Of the Primates only the anthropoids have these blood groups although similar groups have also been found in some of the lower Old World monkeys (table 1).

Table 1

BLOOD GROUPS OF MAN, APES AND MONKEYS (ACCORDING TO MOURANT, 1954)

Primates	0	A	B	AB
Man	+	+	+	+
Chimpanzee	+(13)	+(110)	—	—
Gorilla gorilla	—	+(13)	—	—
Gorilla beringei	—	—	+(2)	—
Orangutan	—	+(7)	+(8)	+(4)
Gibbon	—	+(1)	+(6)	+(1)
Rhesus monkey (groups found in saliva)	+	+	+	+

(The figures in brackets indicate the number of individuals examined.)

The many blood transfusions made by Ch. Troisier (1931) from different chimpanzees with group II (A) blood to human beings of the same blood group were successful and showed no adverse manifestations. Much earlier, in 1900, Hans Friedenthal's experiments of injecting human blood into the vascular system of a chimpanzee were equally successful. Experiments on the lower monkeys showed that, judging by the reddish colour of the urine, human erythrocytes underwent haemolysis in the blood of the monkeys; human blood was, therefore, alien to the animals. This was confirmed when the whole blood of a baboon was mixed with human blood serum; the erythrocytes in the baboon's blood were destroyed. When a similar experiment was carried out with chimpanzee blood the erythrocytes did not undergo any changes.

There are also astounding similarities in the propagation of man and the anthropoids. The ovum and spermatozoid of chimpanzees or gorillas

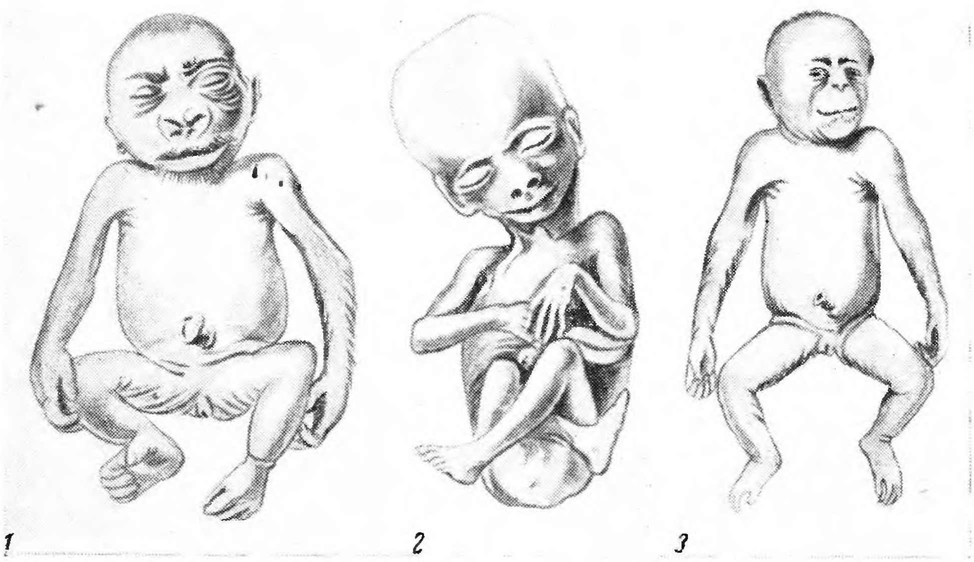


Fig. 16. Human and anthropoid foeti:
1—gorilla; *2*—man; *3*—chimpanzee. After H. Klaatsch, 1915 (*1*), L. Selenka, 1905 (*2*), and A. Schultz, 1929 (*3*).

are almost indistinguishable from the human either in size or shape. The foetus of an anthropoid ape (fig. 16) bears a much greater resemblance to the human foetus than those of the other monkeys (Harms, 1956; Stark, 1956).

The chimpanzee's period of gestation lasts from 210 to 252 days, about 235 days on the average, that of the orangutan about 275 days, that of a human being about 265 to 280 days (that of the gorilla is probably about the same). In this respect the gibbons are closer to the lower monkeys as the female is pregnant for no more than 210 days.

In the course of 30 years about a thousand lower monkeys have been born at the Academy of Medical Sciences Medico-Biological Station in Sukhumi; numerous observations have been made (Voronin, Kanfor, Lakin, Tikh, 1948; Proceedings of the Sukhumi Medico-Biological Station, Acad. Med. Sciences of the U.S.S.R., Vol. 1, 1949; Malis, 1952; Utkin, 1954; Yeligulashvili, 1955). During the whole of this period three pairs of twins have been born, two hamadryas baboons and one rhesus monkey pair. Anthropoid apes breed more rarely in captivity. A gorilla baby was born in Columbus, Ohio, U.S.A., on December 22, 1955. The period of gestation and parturition of chimpanzees has been observed since 1915. There have been about 75 cases of chimpanzees bearing young in captivity of which two were cases of twins (fig. 17). Doctors and scientists have established the close resemblance between human beings and chimpanzees during pregnancy and parturition. The young chimpanzee with thick hair on its head and a bare body more closely resembles a human baby than an adult chimpanzee does an adult man.

Fig. 17. Chimpanzee twins: newborn male (right) and female (Moscow Zoological Gardens, 1939).
Exhibited at Moscow Institute and Museum of Anthropology.

Fig. 18. Newborn chimpanzee.
After R. and A. Yerkes, 1934.

The development of the anthropoid skeleton in the uterine period, judged on the basis of secondary ossification, is slower than that of the lower monkeys and is close to that of the newly-born human baby (Wokken, 1949). We may connect this with the fact that the young of the guenon (Cercopithecus), for example, is helpless for no more than two or three months while the young chimpanzee is helpless over a much longer period—five to six months. The young chimpanzee begins to move about independently only when it is six months old (figs. 19-21), and for about two years clings to its mother or keeps close to her, is suckled by her and sleeps in one nest with her.

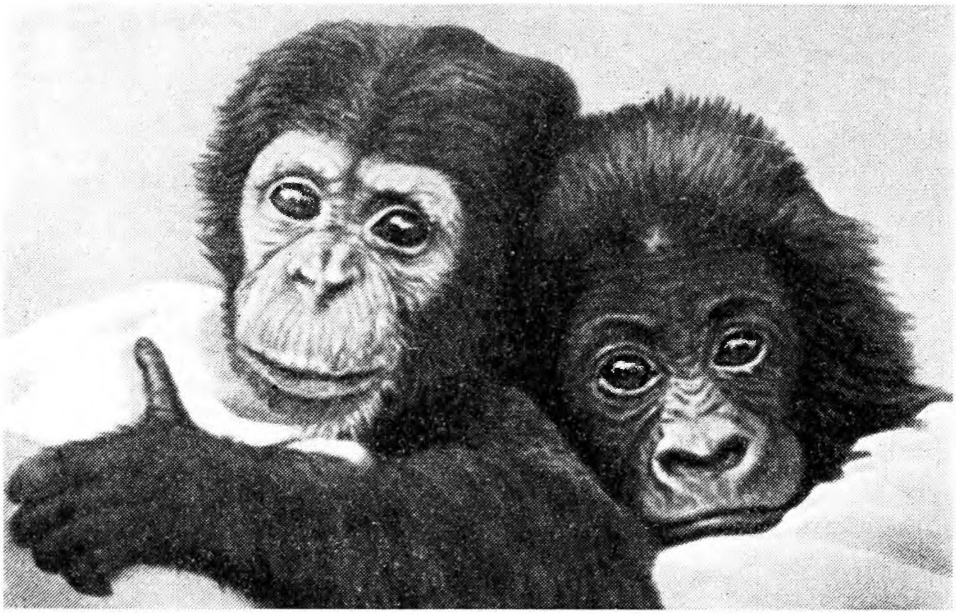


Fig. 19. Young chimpanzee (left) and gorilla.
After F. Merfield, 1954.

The baby chimpanzee cuts the last of its 20 deciduous teeth at about 12 months which after a certain period (less than the five-year period of a human baby) are replaced by permanent teeth; all the 32 teeth grow in the course of little more than 10 years. The baby chimpanzee increases in weight by periods corresponding approximately to those of the human child (Schultz, 1956).

In 8 to 10 years female chimpanzees reach the age of puberty, the males at about 12 years; the male gorilla reaches puberty at about 14 years or even later. The menstrual cycle of the chimpanzee is about 30 days, in some females even more, up to 40 days.

Female chimpanzees (and gorillas) differ sharply from human beings during the menstrual cycle by the formation of oedemic swellings of the "sexual skin," known as menstrual cushions. The same is observed

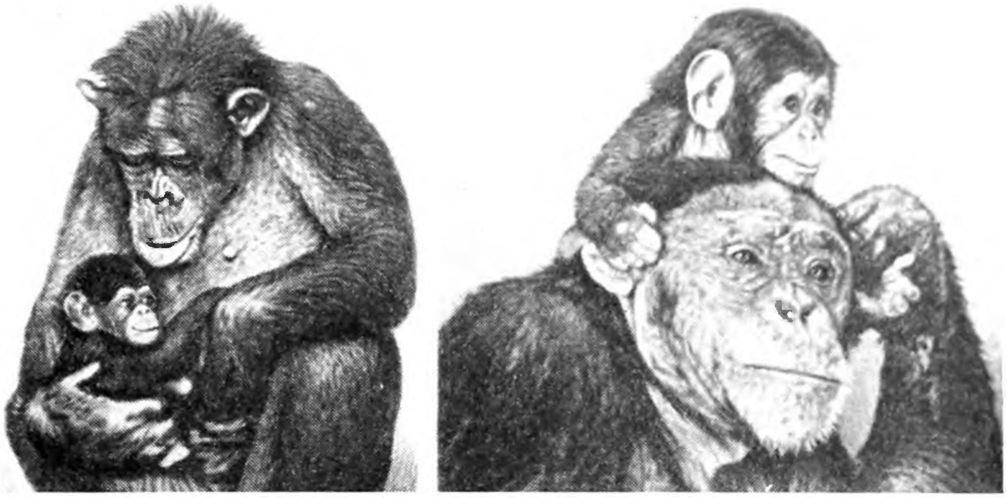


Fig. 20. Female chimpanzee, Bubu, with offspring, Jubilee, at 14 days and at three months; London Zoological Gardens.

After S. Zuckerman, 1933.

among some of the lower monkeys, the baboons, macaques and mangabeys (Nesturkh, 1946; Alexeyeva and Nesturkh, 1958). Orangutans and gibbons have no such swellings although something similar appears on the skin of the pregnant orangutan.

The ape's span of life is not known with any degree of accuracy since data on the longevity of apes in captivity are rather scanty. It must be remembered that apes die prematurely from disease, mostly of the alimentary tract and respiratory organs. It has been reported that one female chimpanzee lived to the age of 60 (R. and A. Yerkes, 1934, p. 259). There is also reliable information concerning a male chimpanzee brought from Africa who lived 39 years in captivity and left numerous progeny (R. Yerkes, 1945). Gorillas have rarely lived more than 20 years in captivity; two orangutans lived 35 years and a gibbon nearly the same length of time; of the latter it is known

Fig. 21. Young chimpanzee, Georgie (San Diego Zoological Gardens, U.S.A.).

After B. Benchley, 1944.

that he was an adult when captured and after twenty years in a cage his muscles were still as strong, his teeth as sharp and his nature as untameable as the day he arrived. Baboons have lived in captivity more than 50 years. Even lemurs are long-lived and have been kept in captivity up to 25 years (Hill, 1953).

From what has been said we may draw three conclusions. Firstly: the Primates are long-lived in comparison with the majority of other mammals (excluding elephants and whales). Secondly: under natural conditions the big anthropoids apparently live several decades and such giants as the gorilla and the orangutan probably live 50 or 60 years or more. Thirdly: the present-day longevity of man is to be explained by the well-founded assumption that his nearest ancestors, the Upper Tertiary fossil anthropoids, were long-lived. Man's span of life has obviously increased under the more favourable conditions of social life and now greatly exceeds that of the anthropoids, occasionally reaching 100-150 years and even more.

The facts mentioned above show that Thomas Huxley's opinion that man is anatomically more closely related to the apes than the latter to the lower quadruped monkeys still holds true.

Since the close relationship existing between man and the higher apes applies also to the organs of reproduction the idea has long existed of joining the egg cells and spermatozoid of man and the higher Primates by artificial insemination.

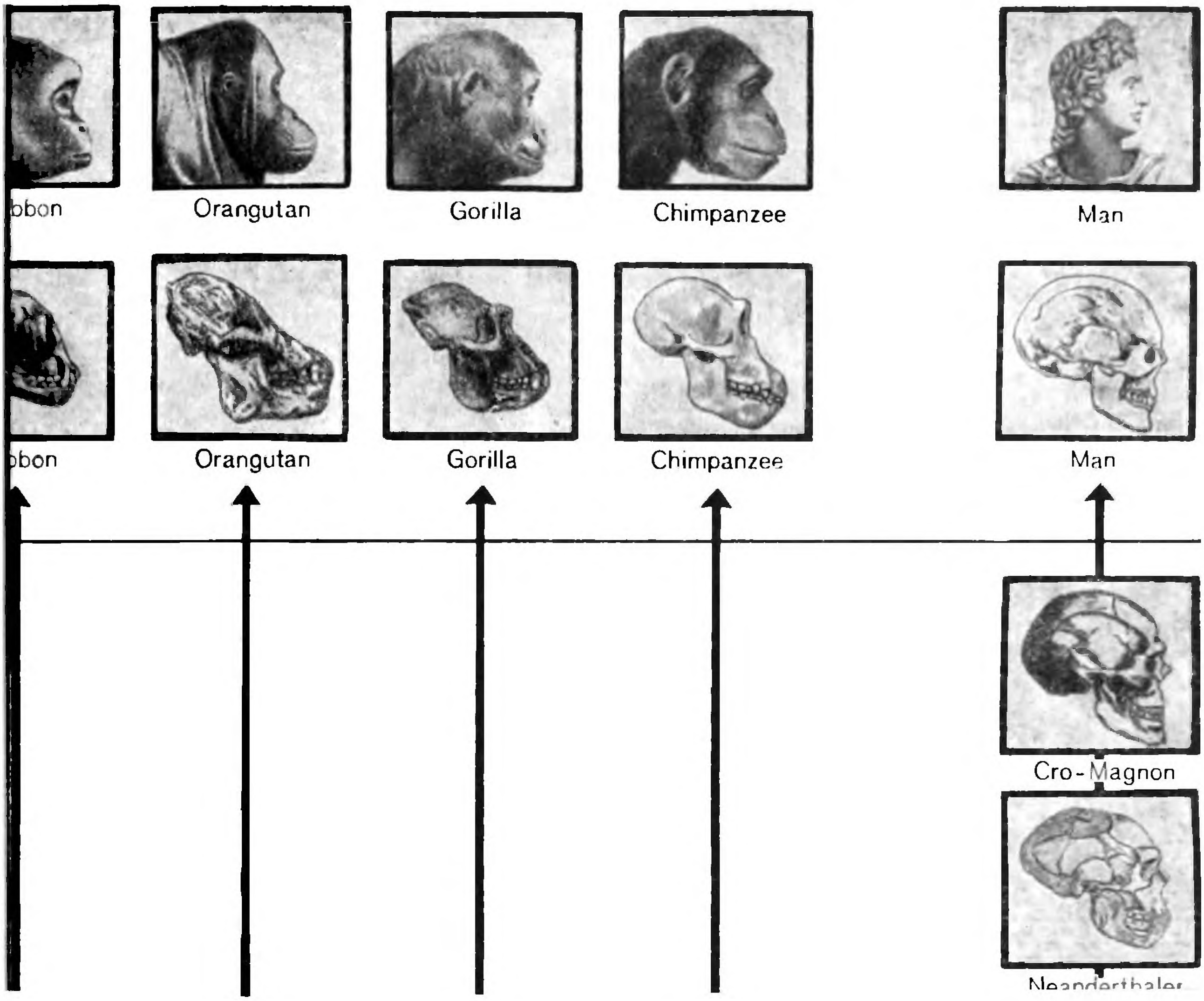
Hans Friedenthal broached the idea 50 years ago on the basis of his experiments on the similarity of the blood of man and the apes. There are many known cases of interspecific and even more remote crossing among other mammals. There have been quite a large number of cases of crossing of Primates in captivity—among the lemurs and the Old and New World monkeys—that have produced not only interspecific but even intergeneric hybrids.

A noteworthy case on an intergeneric hybrid occurred at the Sukhumi Medico-Biological Station at the beginning of 1949; a female hamadryas baboon bore a female offspring, Prima, by a male macaque that was itself a hybrid produced by crossing a pig-tailed macaque ("lapunder") with a macaque rhesus. Prima bears obvious characteristics of both her parents. The same parents soon produced another hybrid offspring, also a female, named Marquise.

Interspecific and more remote crossing among the monkeys of that station (now the Institute of Experimental Pathology and Therapy) have produced about 50 hybrids. Their hereditary peculiarities are being studied at the Institute as well as their morphology, physiology and pathology.

It is theoretically possible to assume that hominids could be crossed with anthropoids, with a female chimpanzee, for example.

Such experiments, naturally, are fraught with great difficulty. Even without them anthropology is in possession, as we have seen in part,


bbon
Orangutan
Gorilla
Chimpanzee
Man
bbon
Orangutan
Gorilla
Chimpanzee
Man
Cro-Magnon
Neanderthaler

of very extensive data confirming Darwin's theory of the natural descent of man from the animal kingdom. To this evidence must be added the numerous fossil remains of Tertiary and Quaternary apes and monkeys that have been discovered.

2. EXTINCT ANTHROPOIDS

It is to be assumed that the Old World monkeys derived from local forms of prosimians in the first half of the Tertiary Period; the latter is usually divided into five epochs. The three older, Palaeocene, Eocene and Oligocene, lasted approximately 8, 12 and 12 million years respectively and constitute the Palaeogenic Epoch while the two later, Miocene and Pliocene approximately 16 and 11 million years, form the Neogenic.

The Tertiary Period, therefore, lasted for about 60 million years. During this long period of time monkeys derived from the prosimians or half-monkeys and then underwent a further evolution. In the course of this evolution of the Primates many species of arboreal anthropoids came into being; terrestrial species of these apes appeared later, among them man's immediate ancestors.

We have only fossil bones by which to study the evolution of the apes and these, unfortunately, consist mostly of jaws and teeth; skulls and the various bones are very rare, to say nothing of whole skeletons with the one exception of the Oreopithecus bambolii discovered in Italy quite recently (Hürzeler, 1958). The fossil material available, however, is sufficient to give us a general idea of how the higher monkeys or apes developed in the Tertiary and later in the Quaternary periods (figs. 22 and 23). In this respect the shape, structure and size of the molar teeth is of great significance.

How are the molar teeth of an ape to be distinguished from those of a monkey? A close examination of the molars will show that the cusps on the teeth of various groups of monkeys are differently interconnected. The lower Old World monkeys, for example, have the four chief cusps on the lower molars joined in pairs (the protoconid with the metaconid in front and the hypoconid with the entoconid behind) to form two high enamel ridges across the teeth. Such ridges are not to be found on the molars of the higher apes where there is only a single, low ridge that crosses the tooth diagonally (see p. 49).

The cusp pattern of man's teeth clearly relates him to the anthropoid type although the human pattern has some features of its own that developed after man had branched off from the main stem of the great apes in the Upper Tertiary. On modern man's lower molars the four main cusps are almost equal in area and the furrows between them form a more or less distinct cross, like a + sign.

Another pattern is sometimes met with on some modern human molars due to the first internal cusp of the lower molar (metaconid) occupying a greater area than the second. On account of this excessive

growth the furrow between these cusps goes farther to the back of the tooth than that between the two main exterior cusps, the protoconid and hypoconid.

Such a pattern is common to both existing and extinct apes and immediately reveals a "simian substratum" in the structure of man's teeth. This cusp pattern was first remarked in the Dryopithecus, an important link in man's line of descent, and has been given the name of the Dryopithecus pattern. As it is found on human teeth it is one of the most important proofs of man's descent from the apes.

The dental system of man and all the Old World monkeys consists of 32 permanent teeth. Each half of the jaw contains two incisors, one canine, two premolars and three molars. Human teeth are set close together without a hiatus or diastem between the upper canines and the incisors and between the lower canines and the premolars that are typical of all monkeys and apes.

The absence of these diastems in man is to be explained by the fact that his canines have become so small that they do not project beyond the other teeth. The roots of the canines, however, are longer, apparently because our ancestors had canines with a much bigger crown which caused them to project beyond the other teeth as is the case with modern apes.

The last, third molars or wisdom teeth in man are greatly retarded in growth and erupt much later than the others. They have a less distinct formation than the first and second molars and are to a great extent rudimentary. One or two of the wisdom teeth of some people never erupt and in rare cases three or even all four of them fail to erupt.

Another proof of man's descent from a species of ape is to be found by a study of the milk teeth of which there are only 20 in man and in all Old World monkeys; in each half of the jaw there are two incisors, one canine and two molar teeth. There are two points of interest connected with the milk teeth; shallow furrows between cusps on the molars, very similar to those typical of the chimpanzee, occur in the milk teeth of all children; and on the first lower molars there is a special cusp (paraconid) situated in an anterior position which has been inherited from man's very remote ancestors, the Early Tertiary prosimians.

One of the most primitive of the fossil apes is the tiny Parapithecus. Only the lower jaw and teeth of this tiny ape are known and they were discovered in 1911 by Max Schlosser near Fayûm, in Egypt, together with the jaw of the Propliopithecus, a somewhat larger ape (figs. 24 and 25). If the Parapithecus was about the size of a cat the body of the Propliopithecus may be compared with that of a small dog.

Judging by the shape and other features of the jaw and teeth the Parapithecus was the more primitive and the Propliopithecus the more developed. Nevertheless the pattern of the cusps on their lower molars is the same as that of the later anthropoids, including existing types, i.e., it is similar to the Dryopithecus pattern.

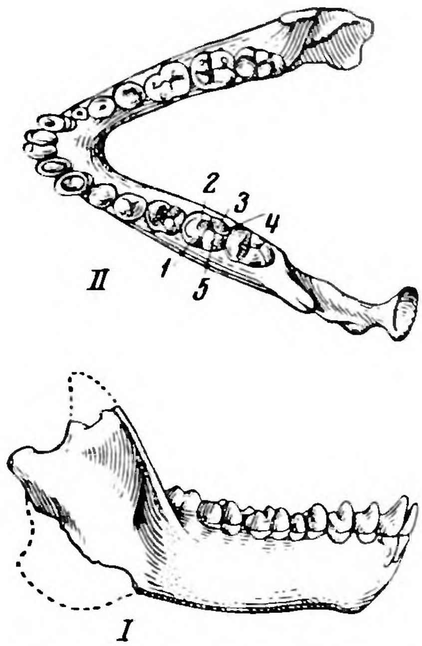


Fig. 24. Mandible of Parapithecus fraasi Schlosser found in Lower Oligocene strata at Fayûm, Egypt. *I* and *II*—right lateral and superior aspects; *1*—protoconid; *2*—metaconid; *3*—entoconid; *4*—hypoconulid; *5*—hypoconid. $^5/_4$ natural size. After M. Schlosser from O. Abel, 1931.

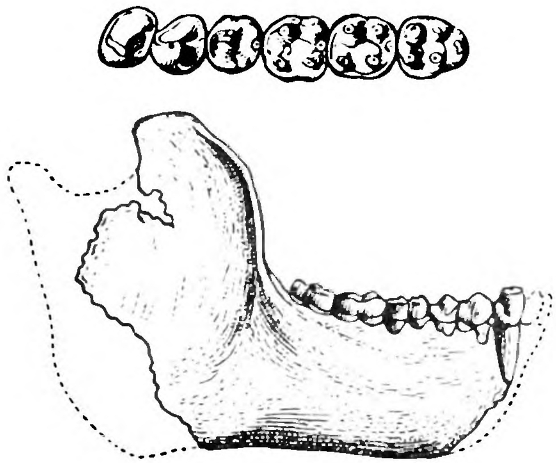


Fig. 25. Mandible of Propliopithecus haeckeli Schlosser found in Lower Oligocene strata at Fayûm, Egypt. Right lateral aspect, partially restored. Upper—teeth, from canine to third molar. Mandible—natural size; teeth—$^4/_3$ natural size.
After M. Schlosser from O. Abel, 1931.

The relatively more primitive nature of the Parapithecus is determined, in particular, by the fact that the canine tooth is not prominent so that Schlosser himself mistook the neighbouring incisor which projects beyond the other teeth for a canine. Schlosser, therefore, gave the dental formula as 1.1.3.3. On account of this he placed the Parapithecus close to a lower primate, the tarsier, which the Parapithecus resembles in another respect: it has a very considerable angle (33°) between the right and left halves of the jaw. A later study of the jaw made by Gustav Schwalbe, the eminent comparative anatomist and anthropologist, showed that the dental formula of the Fayûm monkey was the same as that of all the Old World monkeys: 2.1.2.3. The primitive forms of higher Primates have a recent addition in the newly discovered *Almogaver*, "the ape that avoids mountains," found in the Eocene strata of the southern slopes of the Pyrenees: a fragment of the lower jaw with its teeth has been studied and described by Crusafont and Villalta (1954). The Amphipithecus was discovered somewhat earlier (Colbert, 1937) in the Eocene strata at a place 60 km. from the town of Mogaung in Burma. This form is of great help in understanding the descent of the monkeys and apes.

The next stage in the evolution of the fossil anthropoids is represented

by the Propliopithecus. It bears some resemblance to the gibbon but is smaller in the body. Some scholars believe the Propliopithecus to be a gibbonoid stage in the evolution of the anthropoid apes and man. Be that as it may, specialists are fairly unanimous in accepting the Propliopithecus as a distant common ancestor of the modern anthropoids and man. Fossil anthropoids in different lines of evolution emerged from the groups represented by the Parapithecus and Propliopithecus.

On the line of evolution from the Propliopithecus to the modern gibbon is the Pliopithecus whose jaw was first discovered in France (Lartet, 1837). This was the earliest discovery of a fossil anthropoid and the honour of making it belongs to the French anthropologist Edouard Lartet. The chin of the Pliopithecus, like that of other anthropoids, recedes very considerably. The canines are more prominent than those of Propliopithecus. In general, the jaw is so obviously similar to that of the gibbons that the Pliopithecus, now known from jaws and teeth found in France, Germany, Switzerland and Mongolia, undoubtedly represents an important link in the line of descent of these tiny anthropoids.

Propliopitheci and Pliopitheci inhabited the rich and abundant tropical forests that tens of millions of years ago covered large areas of Europe, Asia and Africa. The wealth of food and the relatively small number of carnivores in the trees favoured the biological development of the lower and higher monkeys (at this period the South American monkeys also underwent progressive development).

We may assume that progress made by the higher monkeys in this period included the following: 1) the assimilation of new modes of locomotion such as brachiation and cruriation; 2) development of the organs of sight and touch (the latter mainly on the palms of the hands); 3) greater procreation; 4) development of a gregarious way of life; 5) the intensive occupation of large areas of the continents; 6) the emergence of new species; 7) the emergence and perfection of new features of adaptability to constantly changing natural conditions. In the anthropoids it was probably expressed in: 1) greater mutation due to environmental influences; 2) increased size of the body; 3) development of the brain; 4) development of higher nervous activity, greater intelligence and more complicated and varied behaviour; 5) the development of more complicated forms of the maternal instinct; 6) the appearance (among the big anthropoids) of the nest-building instinct.

The fossil remains of anthropoids found in the Miocene strata and aging from 27 to 12 million years bear evidence of the increasing size of the body. First and foremost among them are the Dryopitheci of which we have mandibles, teeth and a fragment of the shoulder-blade.

The first Dryopithecus mandible (fig. 26) was found in France in 1856 and was described by Edouard Lartet. It is bigger, more massive and higher than that of the Pliopithecus; the canines constitute a powerful weapon as in modern anthropoids; there is the same pattern of

cusps on the surface of the molars that is found today in the descendants of the Dryopitheci, i.e., primarily in the modern great apes (fig. 27).

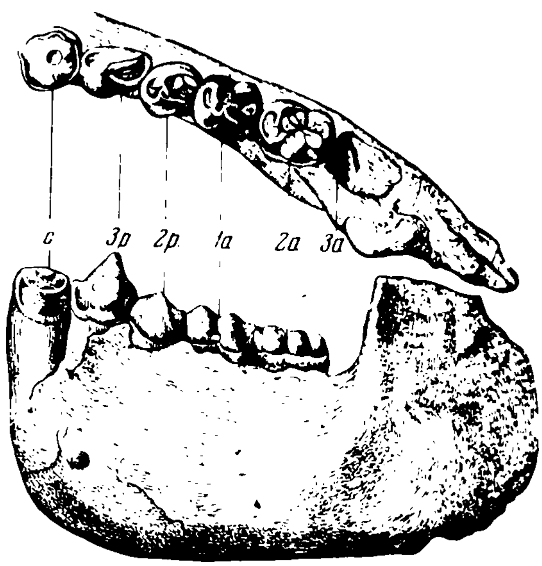


Fig. 26. Mandible of Dryopithecus fontani Lartet:

1—left lateral aspect; *2*—superior aspect. $^7/_8$ natural size. After O. Abel, 1931.

We mentioned this pattern because it is not only found in present-day anthropoids but sometimes also occurs in man.

We repeat that another pattern, the cruciform, is typical for man due to the shortening of his dental equipment in general and of the molars in particular; all four cusps occupy almost equal areas and are separated by longitudinal and transverse furrows. In the anthropoids the antero-interior cusp (metaconid) is bigger than the posterior (entoconid) cusp on account of which the furrow between them is not opposite that which separates the two exterior cusps (anterior and posterior, i.e., protoconid and hypoconid). This rather intricate detail has proved to be of great importance for a conception of the evolution of Primates and the development of the highest of all Primates—man.

With which of the modern apes is man most closely connected in origin? We may begin by excluding the gibbons and, particularly, the orangutans who have many features showing their excessive specialization. In these two anthropoids adaptation to life in the trees has been carried to extremes and has arrived at the mode of locomotion known as brachiation which involves climbing, swinging and leaping from branch to branch and from tree to tree using the arms alone. Such apes are sometimes called brachiators.

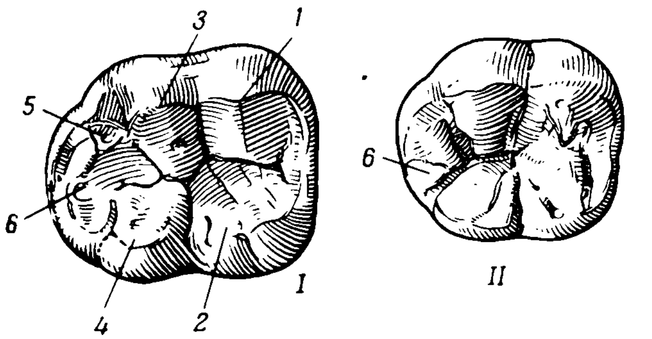


Fig. 27. Grinding surface of lower molars:

I—Dryopithecus pattern on third lower molar of Dryopithecus chinjiensis Pilgrim; *II*—crux pattern typical of modern man. *1*—protoconid; *2*—metaconid; *3*—hypoconid; *4*—entoconid; *5*—hypoconulid - mesoconid; *6*—sixth cusp. $^5/_2$ natural size. After W. Gregory from O. Abel, 1931.

The gibbons are swift brachiators who can swing for hours through the trees, flying straight from one tree to another

and offering a spectacle in which unusual agility is combined with movements of great elegance.

The orangutans, with their heavy bodies and long, brittle bones, are slow brachiators who study a branch before they will trust themselves to it. Orangutans climb rather than swing from branch to branch.

The slow-moving orangutan stands out among the anthropoids with his shaggy russet pelage, cheek-pads, sternal glands of unknown significance, the absence of a nail on his rudimentary great toes and other evidence of specialization; the orangutan is an obvious deviate from type that has followed a line of development differing from that of the gibbon, chimpanzee and gorilla and still farther from the line from which man emerged.

The molars of the orangutan are noticeably different from those of the gorilla or chimpanzee, the cusps are lower, there are several additional cusps and the wrinkles that cover the grinding surfaces are very shallow. The chimpanzee's molars have many wrinkles and they are of average depth; the gorilla has few of them and they are very deep. Primatologists can easily recognize the teeth of the modern apes, especially those of the gibbons. The teeth of fossil anthropoids also differ and can be recognized, although this is a difficult enough task owing to their great individual mutations; there are, furthermore, more species and genera than there are of the living apes.

Judging by the degree of similarity in the structure of the teeth and jaw the ancestors of the orangutan are best represented by two fossil anthropoids, the Palaeosimia and the Sivapithecus. The third upper right molar of the Palaeosimia was found in 1915 near Simla in the Siwalik foothills of the Himalayas where a rich collection of the bones and teeth of extinct monkeys was found in the Miocene and Pliocene strata. The grinding surface of the tooth is covered with easily identifiable tiny wrinkles which gave this ape the name of "wrinkle-toothed (rugosidens) Palaeosimia". Since 1879 the jaws of a number of different Sivapitheci have been discovered in the Miocene strata of the Siwalik Hills, but it was not until 1938 that Milo Hellman succeeded in reconstructing their dental arches (Gregory, Hellman and Lewis, 1938). Since several discoveries of the teeth of fossil orangutans have been made on the Asian mainland—in South China—where they lived in the Quaternary Period it may be assumed that the orangutan was indigenous to that area.

Compared with the orangutan and the gibbons, the chimpanzee and the gorilla, descended from the Dryopithecus group in the mid-Tertiary Period, display much greater approximation to man. From the same group the nearer ancestors of man also emerged.

It must be admitted that we are, unfortunately, even today unable to get an accurate picture of the body of the Dryopithecus. It is true that there exist about a dozen lower jaw fragments with several dozen

teeth, but the upper teeth are known only from a few isolated samples. The upper jawbone (maxilla) has not been found; the same applies to the skull. All that is known of the skeleton is a humerus and of that but a fragment.

Despite this scholars have succeeded in showing by the tooth pattern and other features of the Dryopithecus that Dr. germanicus Abel (Germany) could be the ancestor of the chimpanzee. Dr. fontani Lartet (France) or Dr. punjabicus Pilgrim (India) of the gorilla; Dr. darwini Abel (Austria) belongs to man's ancestors (fig. 28). But there are other fossil anthropoids that more or less fit into a place among the ancestors of the chimpanzee, gorilla and man.

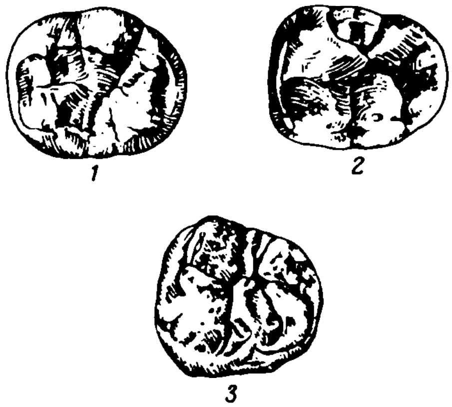


Fig. 28. Lower molars of Dryopitheci.
1—Dr. germanicus Abel from Lower Pliocene strata of Bohnerz in Trochtelfingen, Schwaben—left second molar; *2*—Dr. punjabicus Pilgrim from Miocene strata in Siwalik Hills at Simla, India—second right molar; *3*—Dr. darwini Abel from Middle Miocene strata at Neudorf, near Vienna—left last molar. $^2/_1$, $^3/_2$, $^3/_2$ natural size. After O. Abel, 1931.

In 1933, in East Africa, the fragment of a maxilla with a canine tooth and all the molars intact was discovered; it belongs to an anthropoid ape that lived at the beginning of the Miocene Epoch, about 25,000,000 years ago. A fragment of the mandible was also found. This ape was called the Proconsul, after a chimpanzee named Consul in the London Zoological Gardens.

Later finds of the remains of fossil bones, a skull among them, on Rusinga Island in Lake Victoria, show that this monkey occupies an intermediate place between the primitive cercopithecoid type and the later anthropoids. The skull shows features that are specific to the common ancestral group of the lower and higher catarrhine monkeys —the protocatarrhine group; among the features are: the symphysis of the lower jaw is short, the lower incisors are small and placed vertically, the intermaxillary bones are narrow, the nasal orifice is pear-shaped (apertura piriformis) and

Fig. 29. Fragments of jaws of Ramapithecus brevirostris Lewis.
1—right half of mandible; *2*—right half of upper jaw. Natural size. After G. Lewis, 1934.

there is no supra-orbital ridge; a cast of the cranium shows that the central or rolandic sulcus is more anterior; the level of encephalic evolution is not high, the brain being small in size; the intero-posterior cusp (hypocone) of the upper molars grows from the protocone and not from the rim (cingulum) of the enamel.

Some scholars place the Ramapithecus among man's ancestors. Two fragments of an upper and a lower jaw from two different individuals (fig. 29) were taken from the Siwalik Hills in 1934 and 1935 from Lower Pliocene strata. It is important to note that in the upper jaw there is no diastem between the sockets of the canine and the first premolar for the lower canine to enter when the jaws are closed; this is evidence for including Ramapithecus among man's ancestors rather than the contrary.

In the Miocene and Pliocene epochs great changes took place in the manner of life of fossil anthropoids and numerous other animals on account of the tremendous processes that led to the transformation of the continents. In the course of these millions of years the gigantic mountain chains of the Old World rose up; in many places the climate became drier and more continental; the dense masses of the tropical jungles began at first to thin out and then to disappear.

Like many other tropical animals, the monkeys were accustomed to life in the forests, in the trees; those who did not manage to adapt themselves to the new conditions in the tremendous open spaces that were formed, in most cases died out; some of them moved to the south and only a few, such as the baboons and man's anthropoid ancestors, went over to a life lived exclusively on the ground.

The expanses of tropical vegetation that have remained from the time of the geological revolution and the transformation in the surface of the continents that came with it, are much smaller in the Old World than they are in South America. The majority of the lower and higher catarrhine monkeys, therefore, paid frequent visits to the ground in search of additional food; this cannot be said of the capuchin (Cebus), marmoset (Hapale) and other New World monkeys who remained purely arboreal in the extensive forests of the Amazon Basin and the neighbouring regions as far as Central America.

The remains of a fossil anthropoid found in South-East Georgia by Soviet scientists bear testimony to the tremendous changes that took place in the life of the monkeys in that period. Palaeontological excavations, organized in 1939 by Baku University and the Georgian State Museum, were conducted at Udabno, near Gareji Monastery in Kakhetia. Towards the end of the dig one of the members of the party, E. G. Gabashvili, continued the search; quite unexpectedly she found two teeth belonging to a fossil ape very near the surface. Although they lay at no great depth the geological stratum was of considerable antiquity—Late Miocene or Early Pliocene—which showed that the anthropoids must have lived in the Caucasus about 12 million years ago.

E. G. Gabashvili and N. O. Burchak-Abramovich, another member

of the expedition, made a detailed study of this rare find which they published in 1945 and 1946. This find was of great importance to science because up to 1939 no remains of fossil anthropoids had been discovered on the territory of the Soviet Union. A very limited number of teeth and skulls of some monkeys had been found in the early twentieth century in Bessarabia and the south-western regions of European U.S.S.R. and little else (Gremyatsky, 1957).

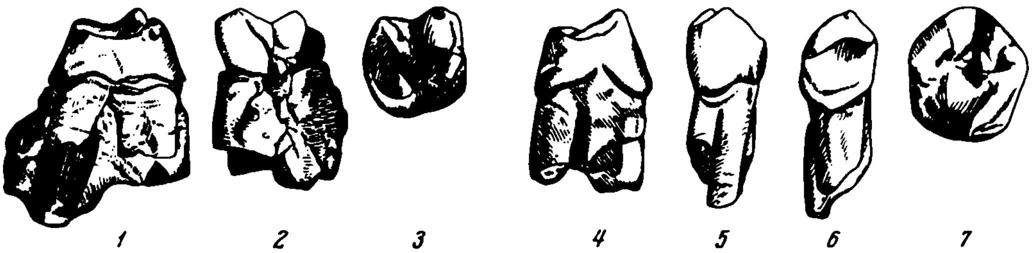


Fig. 30. Right upper teeth of Udabnopithecus garedziensis Burchak-Abramovich and Gabashvili:

1-3—first molar and *4-7*—second premolar; *1*, *4*—oral aspect; *2*, *5*—lateral aspect; *6*—medial aspect; *3*, *7*—grinding surface. $^7/_6$ (1-6) and $^7/_4$ (7) natural size. After N. Burchak-Abramovich and E. Gabashvili, 1945.

The Georgian find consisted of the second upper premolar and the neighbouring first molar (fig. 30). When found they were joined by bone tissue and, therefore, belonged to one individual. The antero-interior cusp (protocone) of the molar is joined to the posterio-exterior cusp (metacone) by a ridge; judging by this the teeth belong to an anthropoid with a smallish body since the teeth are not very big, like those of a chimpanzee. The premolar is interesting for its three roots; this peculiarity is rarely met with in apes; on the upper premolar there are rarely two roots and on the lower two roots are only found by way of exception.

The scholars named the fossil ape they had discovered the Gareji Udabnopithecus. It was a species that became extinct when the Caucasus Range was formed. It is possible that higher and lower monkeys had lived in the tropical forests of the Caucasus until then. No doubt there are remains of bones, skulls and teeth of monkeys and other Primates preserved in the Tertiary strata of different parts of the Soviet Union.

It is still difficult to determine the real place of the Udabnopithecus among the fossil apes or its relation to modern apes (Gremyatsky, 1957) and to man's genealogy. The problem is less difficult in respect of a series of discoveries of anthropoids in the Upper Pliocene and Lower Pleistocene strata of South Africa. These are the Australopithecus and related forms that bear similarity to the chimpanzee, the gorilla and to man. Many scholars have written of closer phylogenetic relations between Australopithecus and man.

The first of the South African anthropoids was found in 1924 in the eastern part of the Kalahari Desert in Bechuanaland. Near the

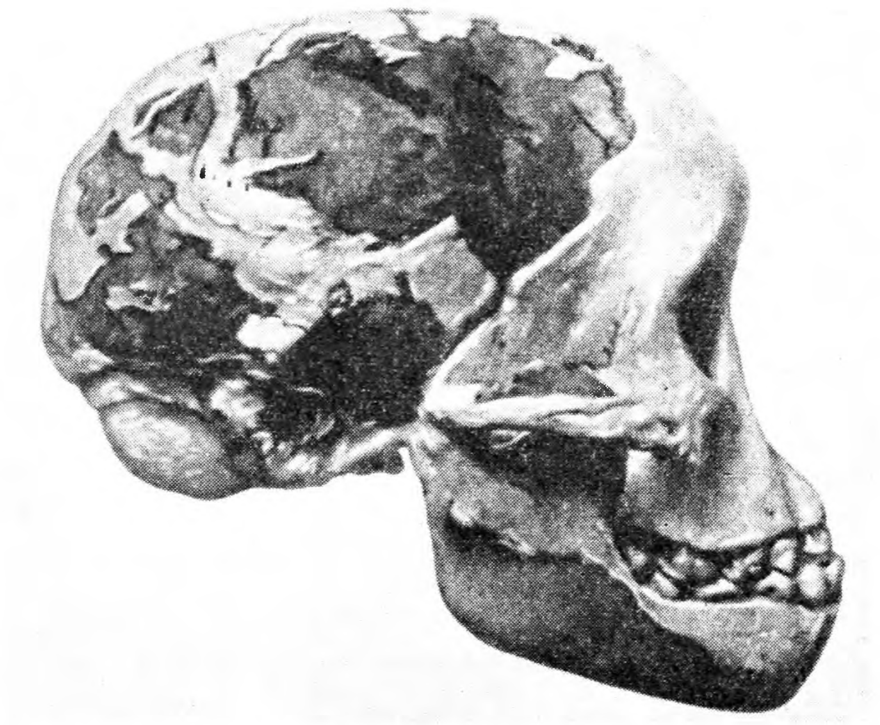


Fig. 31. Skull of Australopithecus africanus Dart. Right side. Inferior edge of mandible added by W. Abel.

$^{3}/_{5}$ natural size. After O. Abel.

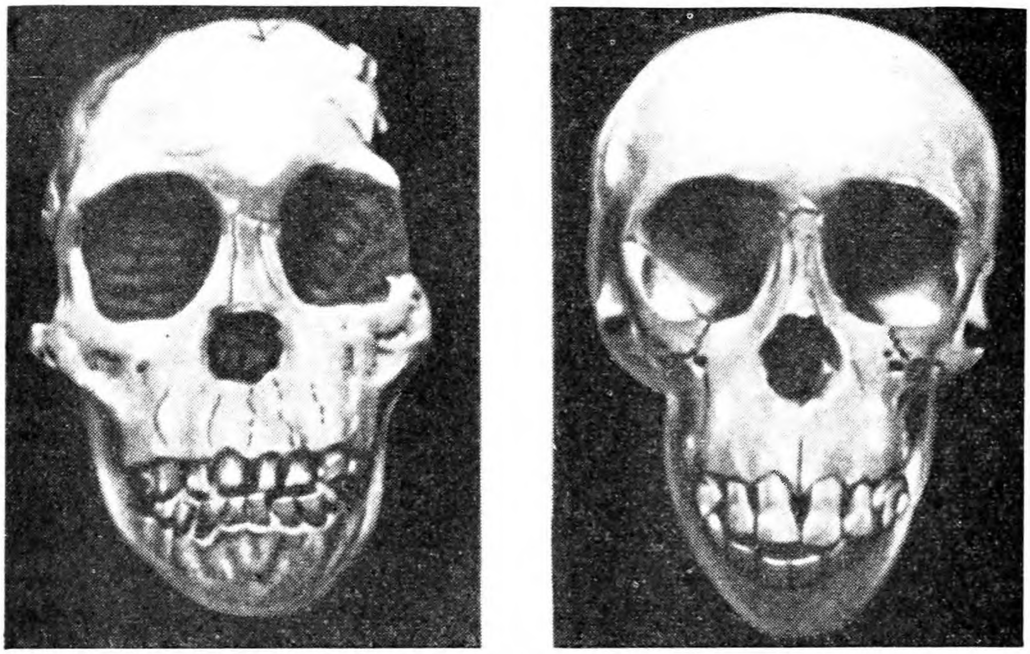


Fig. 32. Cast of Australopithecus skull and (right) common chimpanzee skull, both of same age.

$^{1}/_{2}$ natural size. After O. Abel, 1931.

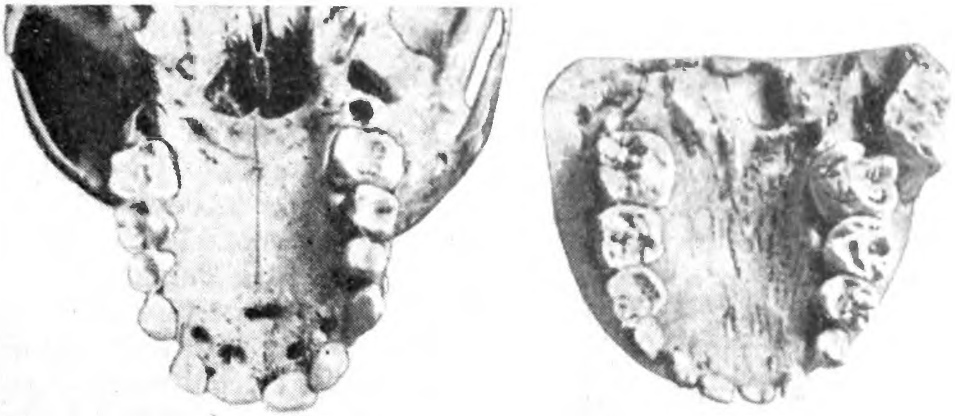


Fig. 33. Upper dentition and palate of Australopithecus (left) and common chimpanzee, both of same age.
$^3/_4$ natural size. After O. Abel, 1931.

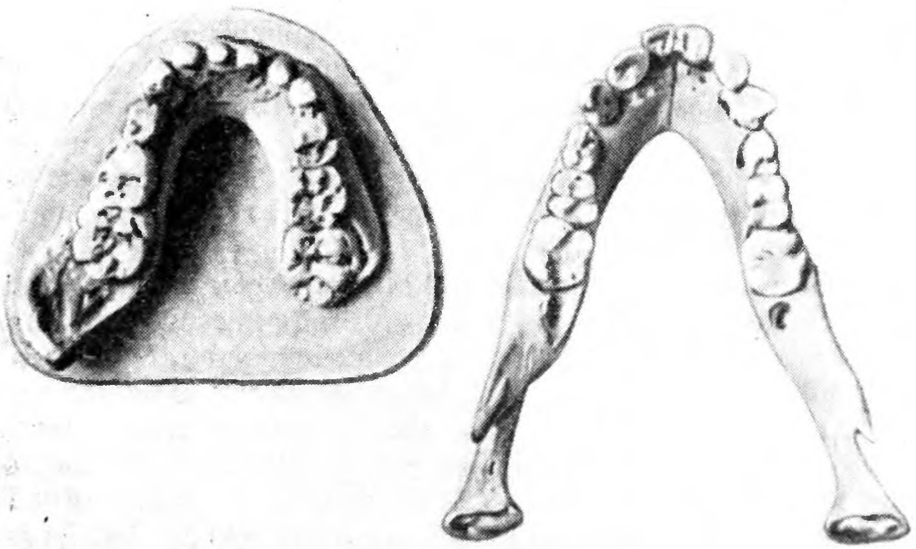


Fig. 34. Lower jaws of Australopithecus (left) and common chimpanzee, both of same age.
$^5/_7$ natural size. After O. Abel 1931.

railway station of Taungs, to the north of Kimberley, the skulls of two adult baboons and the skull of a young anthropoid ape were found in a lime quarry. It was at first believed that the finds were not of great geological antiquity; they were dated as belonging to the first half of the Quaternary Period, even closer to the middle of that period which would give them an age of between 500,000 and 800,000 years. Some-

what later some scholars began to consider the find much older and placed it, for example, at the end of the Pleistocene and even the middle of the Pliocene.

The incomplete skull of the South African anthropoid belonged to a young individual of about five years of age (figs. 31-34). This is shown by the full set of milk teeth behind which can be seen the first permanent molars that are just beginning to erupt. The facial and frontal bones of the skull have been well preserved. Part of the skull forms a continuous whole with the mineral mass that fills it.

The skull was sent to the South African anatomist and biologist, Dr. Raymond A. Dart. He studied the skull and published a brief description in which he proposed calling the newlydiscovered anthropoid the Australopithecus africanus.

The discovery of the "Taungs ape" gave rise to many disputes. Some scholars, Othenio Abel (1931), for example, described it as the skull of the offspring of a fossil gorilla. Others, like Hans Weinert (1932), saw in it more similarity with the skull of a chimpanzee and based their opinion, in particular, on the convex profile and on the form of the nasal bones and orbits.

A third group, among whom were Dart, William Gregory and Milo Hellman (1938), thought that the Australopithecus bore greater resemblance to the Dryopithecus and to man. The cusp pattern on the lower molars differs but little from that of the Dryopithecus.

The supra-orbital ridge of the skull is weakly developed, the canine teeth scarcely project above the others and the face, in Gregory's opinion, is astonishingly pre-human.

A fourth group of scholars, like Wolfgang Abel, drew attention to the signs of specialization that led the Australopithecus away from the human line. For example, the first permanent molars of the Australopithecus differ from human teeth in being broader in the posterior half.

Now let us look at the size of the Australopithecus cranium as described by Dart. V. M. Shapkin, a Soviet anthropologist, employing the precise method he proposed (1937), obtained the figure of 420 c.c. which is not far from Wolfgang Abel's figure of 390 c.c. Dr. Raymond Dart gave the volume of the cranium as 520 c.c. but this figure is undoubtedly an exaggeration. Taking the age of the owner of the skull into consideration the possible volume of an adult Australopithecus cranium was taken as being 500-600 c.c.

The conception of the Australopithecus type was greatly enriched when another skull of a fossil ape was found in the Transvaal in 1936. It was found in a cave near the village of Sterkfontein, not far from the town of Krugersdorp, 58 kilometres south-west of Pretoria. The skull is that of an adult specimen and is very similar to a chimpanzee skull except that the teeth are more like those of a human being. The skull is long in shape: the cranium is 145 mm. long and 96 mm. wide so that the cephalic index is low, i.e., $96 \times 100 : 145 = 66.2$ (ultradolichocephalic).

Dr. Robert Broom, the South African palaeontologist, who had been working for nearly half a century in South Africa on mammals and their evolution, studied the skull of the Sterkfontein fossil ape and announced it to be a new species, Australopithecus transvaalensis. The study of a lower third molar found at the same place which was very big and resembled that of a man compelled Broom to establish a new genus, the Plesianthropus, i.e., an ape closer to man. And so the Sterkfontein anthropoid was named the Plesianthropus transvaalensis.

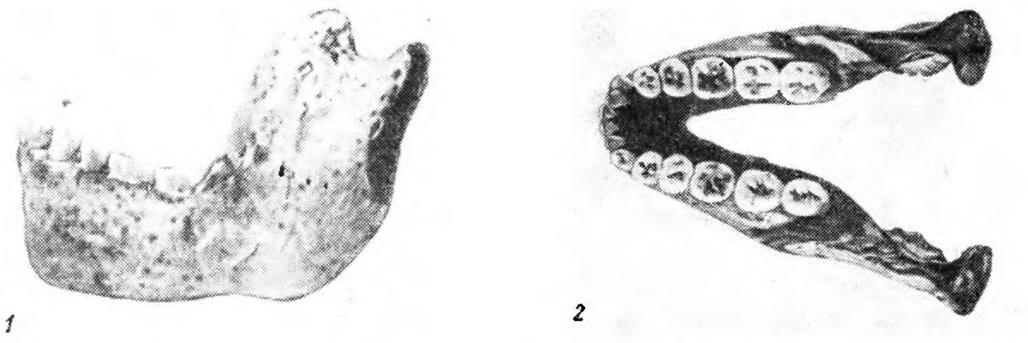
Fig. 35. Skull of Paranthropus crassidens Broom. $^{2}/_{5}$ natural size. After R. Broom from H. Ullrich, 1953

Broom became deeply interested in African fossil apes and the problem of anthropogenesis; he devoted much time and effort to the search for further specimens. Between 1936 and 1947 his efforts resulted in 10 incomplete skulls, 150 isolated teeth and several skeletal bones of the Plesianthropus being found. In 1938 Broom had the good fortune to discover a wonderful fossil skull (fig. 35). The story of the skull is the following. A schoolboy from the village of Kromdraaï dug the skull of an ape out of the hillside near his village, broke it to pieces and took the teeth to play with. Broom got wind of this by accident and with the aid of the boy, who gave him the teeth, found some pieces of the skull *in situ.* The geological age of the skull, apparently, is Middle Quaternary.

When Broom put the pieces of the skull together he was amazed at their resemblance to a human being in the shape of the temporal bone, in the structure of the auditory canal (meatus acusticus internus), in the position of the occipital foramen, nearer to the base of the skull than in living anthropoids. The dental arch was wide, the canines small and the teeth very similar to those of a human being.

On the conclusion of his investigations Broom gave the Kromdraaï anthropoid the name of Paranthropus, an ape close to man. In 1939 some bones of the Paranthropus skeleton were found that greatly resembled the Plesianthropus. Both apes closely approximate the Australopithecus.

In 1948-1950 Broom made a number of new discoveries of South African anthropoids—the Paranthropus crassidens (massive-toothed)



1 2

Fig. 36. Paranthropus mandible:
1—left lateral aspect; *2*—superior aspect. $^2/_5$ natural size. After R. Broom from H. Ullrich, 1953.

(fig. 36) and the Australopithecus prometheus (an ape knowing the use of fire) (fig. 37). From this it is to be assumed that Africa must be rich in the remains of other, still unknown apes (Nesturkh, 1937, 1938; Yakimov, 1950, 1951), especially as the English anthropologist, L. Leakey, in 1947 found the skull of the African Proconsul (mentioned above) in the Kavirondo area of East Africa; the Proconsul has points of resemblance with the chimpanzee.

From what has been said we may draw the conclusion that most probably, in Africa, in the first half of the Quaternary or towards the end of the Tertiary Period several different species of highly developed anthropoid apes had taken form. They had a brain capacity of 500-600 c.c. or even more (with a weight of 40-50 kg.), and jaws and teeth of typical anthropoid pattern but at the same time showing considerable proximity to human teeth.

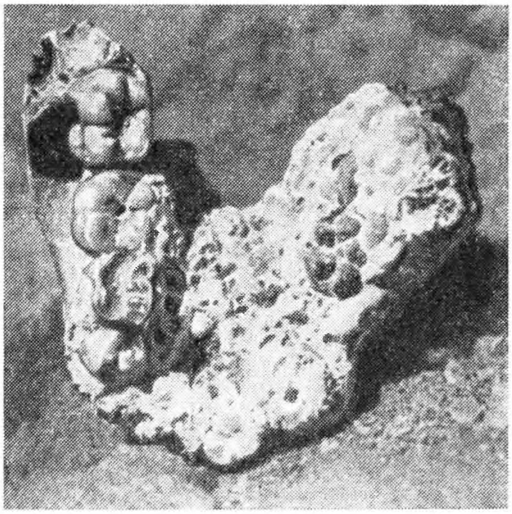


Fig. 37. Mandible of Australopithecus prometheus Dart *in situ*, while being cleaned of breccia.
$^5/_8$ natural size. After R. Dart, 1948.

Some of the African fossil anthropoids even walked on two legs as can be seen from the shape and structure of the long bones and other parts of the skeleton that have been found, for example, the pelvis of the Australopithecus prometheus (1948) or the thigh-bone and tibial of the Plesianthropus (1947). It is also possible that they used sticks and stones as weapons. The Australopithecus lived in savannahs or arid semi-desert regions (fig. 38) and also killed animals for food, hunting hares and baboons.

South African scholars (Broom and Shepers, 1945; Dart, 1949) ascribe the ability to use fire and speech to fossil anthropoids of the Australopithecus prometheus type. There are, however, no facts to support these assumptions. Attempts to present the South African anthropoids as the oldest hominids are without any foundation. There is also insufficient evidence to show that these anthropoids were the ancestors of the whole human race or part of it. The same applies to the Oreopithecus, remains of which were found in Italy, in the Bamboli Hills in Tuscany. Teeth, jaws and fragments of the forearm were found

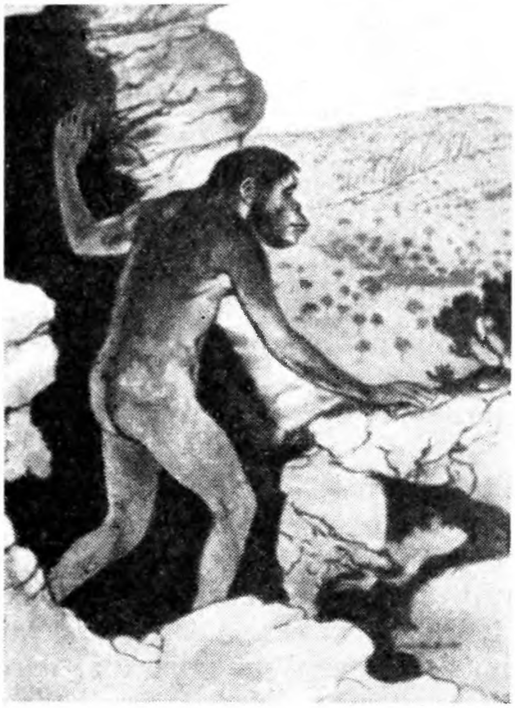


Fig. 38. Australopithecus. Reconstructed by W. E. Le Gros Clark, 1952.
After H. Ullrich, 1953.

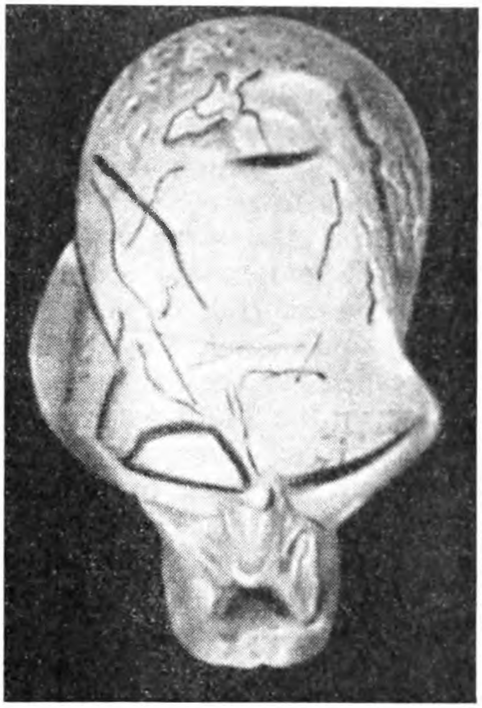


Fig. 39. Skull of fossil baboon showing traces of blows inflicted by Australopithecus.
About $^2/_5$ natural size. After H. Ullrich, 1953.

in Middle Miocene and Early Pliocene strata. These bone fragments and the complete skeleton recently found show that the Oreopithecus bambolii very closely approximated the anthropoids (Hürzeler, 1949, 1954, 1958; Gremyatsky, 1958).

The Australopithecus and Oreopithecus must be, at best, regarded as "nature's unsuccessful attempts" for they are apes that have become extinct. Man derived from one of the South Asian forms of ape that developed from the Early Pliocene anthropoid apes of the Ramapithecus type.

The discovery of the Australopithecus group of South African anthropoids (fig. 40) caused many scholars to ponder anew over the possible

geographical site of the original habitat of man's ancestors, man's birthplace. Dart proclaimed South Africa the cradle of mankind and his opinion was supported by Broom (1946) and Keith (1950).

The idea of Africa as the probable cradle of the human race is not a new one. Charles Darwin, as long ago as 1871, spoke of the African continent as the possible place where man first emerged. He referred to the very important fact that the gorilla and chimpanzee live in Africa and they are man's nearest relatives. We know, wrote Darwin, that modern mammals, living within the bounds of an extensive area, are phylogenically related to extinct forms that lived in the same area. We must remember, however, that in North-East Africa (in Egypt), the remains of the Parapithecus and Propliopithecus, the common ancestors of the living anthropoids, have been found. It would seem more logical, therefore, to place man's ancestral home in North-East rather than in South Africa.

The sum total of other data, however, lead us to seek the habitat of the first man in the southern part of Asia and not in Africa. Fossil remains of anthropoid and lower catarrhine monkeys have been found in the Siwalik Hills in Northern India since 1879; the tooth of a Pliopithecus posthumus was found in Mongolia in 1924 by Max Schlosser, who called the ape the forefather of man; the Udabnopithecus serves to link up the South Asian fossil anthropoids with the Pliopitheci and Dryopitheci of Europe.

The very long and fairly broad belt which has yielded many remains of fossil apes stretched, in the Miocene and Pliocene, from the European shores of the Atlantic Ocean in a direction south-east-by-south as far as the Malay Archipelago (with Java as its centre). Different scholars have placed man's ancestral home in extensive areas of Central and South Asia within the above limits; it is very probable that part of the territory of South-East Asia should also be added. Here we may recall the theories of the Russian scholar, P. P. Sushkin (1928), and the Osborn hypothesis (1933). It is possible that the habitat of primitive man also included part of North-East Africa.

The remains of primitive man found in South-East Asia are further evidence of the Asian habitat of the first man. We do not consider the hypothesis of the South African origin of Pithecanthropus and Sinanthropus to be sufficiently well founded: it is difficult, even impossible, to accept the idea of the first men covering a distance of almost 15,000 km. in a short period; the journey from South Africa would have to follow the strongly indented coasts of the Indian Ocean and across dry land as far as Java or eastward through South Asia as far as the habitat of Sinanthropus near Peking.

Hypotheses on man's origin in North Asia have also been propounded as tropical forests covered this area in the Tertiary Period. According to the Wilser hypothesis the influence of the advancing cold front made man's ancestors move farther and farther south down the Asian

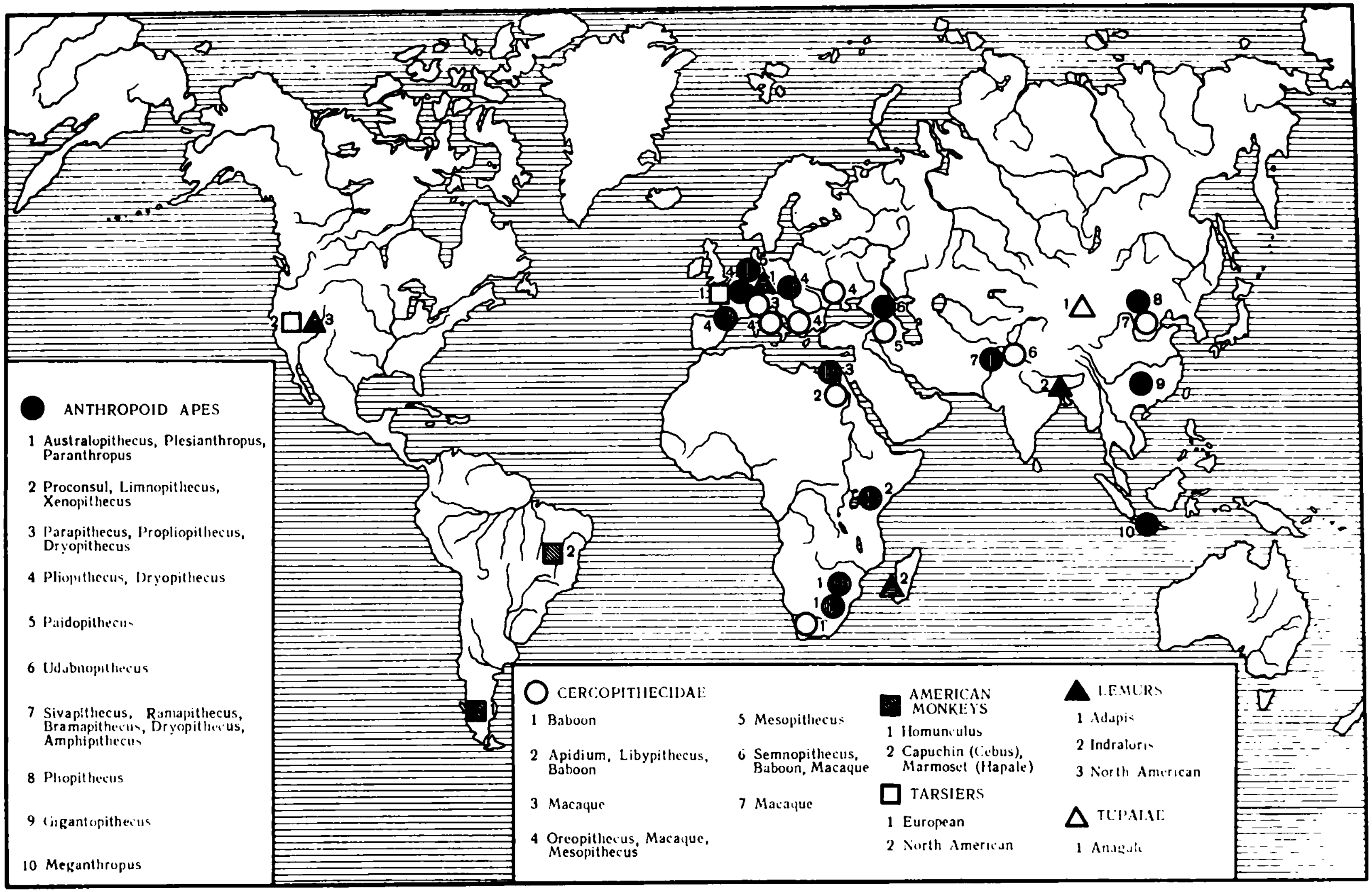


Fig. 40. Sites where fossil Primates have been discovered.

continent, where the transition from ape to man took place in one of those regions. There is, however, no evidence in the palaeontology of the Asian Primates so that the hypothesis lacks conviction.

There is also little chance of finding man's first habitat in Europe which is nothing more than a peninsula of the Afreurasian continent. Absolutely beyond the bounds of probability is the search for the first man in Australia (Otto Schoetensack, 1908) with its archaic world of marsupials; equally improbable is Florentino Ameghino's South American hypothesis (1934), since the time man first reached that continent from Asia is probably no more than 25,000 or 30,000 years ago.

It is quite obvious that the ape's line of evolution was closely connected with the gigantic tectonic processes that transformed the surface of the Earth in the Miocene and Pliocene. It was then that the great mountain folds were formed, the climate changed from wet tropical to subtropical and temperate, even cold in places, and many regions grew drier, the trees grew scantier and huge forests disappeared altogether. Part of the fauna must have perished, part adapted itself to the new conditions and part migrated. Traces of the Neogene (Upper Tertiary) migration of mammals are to be seen in the numerous Asian animals—fossil horses, elephants, ostriches, monkeys—that found their way to Europe and Africa. This migrating fauna has been given the name "Pikermi fauna" from a place in Greece that served them as a halting place during migration and is very rich in bone remains. In living Africa fauna there is a considerable mixture of Pikermi fauna.

Some of the apes, like Mesopithecus pentelici (a monkey intermediate between a marmoset and a gibbon found near Pentelicon, Athens), migrated farther while others, like the Udabnopithecus garejiensis, died out and became extinct on the way; a third group remaining in Asia developed into the Pleistocene Asian apes and were the ancestors of the modern apes and of man. In the majority of cases these latter extinct apes were compelled to take to a part arboreal, part ground way of life; some of them, such as the baboons, kept to the ground completely. Man's ancestors had to adapt themselves to orthograde locomotion on the ground that differed from the pronograde locomotion of the baboons—they walked on two legs and not on four. The conditions for and the possibility of the emergence of man are to be found, first and foremost, in the peculiarities of structure and ecology of the Upper Tertiary fossil apes. As man, too, is an ape-like catarrhine primate he could not have descended from the American monkeys, that in many respects differ sharply from the Old World monkeys. Take for example, the position of the head; for many of the highly developed ring-tailed types, head downwards is the normal attitude. To expect any of the Cebidae to become bipedal and at the same time reduce the external part of the tail, to assume it possible for them to develop an opposable thumb and a highly complex brain cortex, to expect them to develop the entire group of prerequisites necessary for the ape to become man

is quite out of the question. The Hapalidae are no more suitable. Hypotheses that require the descent of man from the American monkeys do not hold water.

It will be sufficient to point to the considerable anatomic dissimilarities between the New and Old World monkeys or apes and, consequently, between them and man. The American monkeys have three premolars instead of two; the external acoustic duct is short and not long; the laryngeal sacs are not derived from Morgagni's ventricles.

Still less admissible is the idea that man has descended from a primate of a much lower anatomical type, such as the tarsiers or lemurs. Nevertheless, such hypotheses are met with in scientific literature although they are a direct contradiction of Darwinism. The next chapter will be devoted to the struggle against anti-Darwinist hypotheses of anthropogenesis.

CHAPTER THREE

CRITICISM OF THE LATER HYPOTHESES CONCERNING THE ORIGIN OF MAN

1. RELIGIOUS EXPLANATIONS OF ANTHROPOGENESIS

From the foregoing it follows that Darwin's theory of anthropogenesis, in the part dealing with the descent of man and with his nearer ancestors on Earth, is fully confirmed by modern biology, a science which is delving ever deeper into the evolution of the animal kingdom and providing a clearer picture of the factors determining the development of organisms.

Darwinism struck a crushing blow at religion with its false teleological conceptions of an eternally predetermined harmony in nature or of the development of living and lifeless nature in accordance with "the divine plan of creation." Even today, there are many people whose minds are filled with the idea that the changes taking place in the world have no connection with each other.

Metaphysically thinking people believe that the world remains unchanged and is directed by the divine being that created it. The idealist, metaphysical philosophy, the basis of religion, is the diametrical opposite of dialectical materialism, a genuinely scientific philosophy. The religious concept of the world prevents an understanding of the emergence of new qualities and does not admit of the transition from quantity to quality. The metaphysicists, therefore, deny the descent of man from the apes.

As far as anthropologists abroad are concerned, the problem of anthropogenesis is still not linked up with the leading role played by work. It is precisely this factor that takes first place in the Marxist explanation of the qualitatively specific process of the formation of man (Gremyatsky, 1934, pp. 33-42).

The capitalist system prevents many bourgeois scientists from correctly understanding the processes of development in nature and society as being effected dialectically; it frequently dictates conclusions that are

in direct contradiction to the facts from which they were drawn. Alfred Wallace (1823-1913), the eminent British biologist and evolutionist, is a singular representative of this class of scientist.

He could not admit that the human body developed from that of an ancestor resembling an ape, and that man's big brain could have developed from an ape brain by means of such evolutionary factors as mutation and natural selection.

In particular, Wallace did not agree that it was possible for the human psyche to have developed on the basis of the higher nervous activity of an animal. "... We possess intellectual and moral faculties which could not have been so developed, but must have had another origin; and for this origin we can only find an adequate cause in the unseen universe of spirit."* In connection with this we may recall that Linnaeus recognized the great similarity between man and the apes but declared that the human soul was a particle of the divine spirit.

Wallace speaks as a true representative of metaphysics. He merely stated openly that which many other evolutionists of his time remained silent about. In his efforts to link up Darwin's theory as closely as possible with religion, he said that the development of the higher intelligence in man had been guided by the law of natural selection for a more noble aim—apparently in order that man, as the most highly developed animal, could think about God!

Another fallacious theory opposed to Darwinism was that the structure of the ape evolved from that of man, the prototype of all animals. Johann Ranke (1897), for example, said that the highest type of skull formation, that of man, is the common starting-point for the development of the skulls of the whole family of mammals.

A similar viewpoint was developed later by Johann Kollmann (1906), who thought that the common ancestor of man and the anthropoid apes had a more highly developed skull, round in shape as distinct from the low skulls of the modern apes. Kollmann based his ideas on the fact that the skull of the newborn ape has a shape more resembling that of an adult man than of an adult ape.

The theories of Ranke and Kollmann have no basis because the skull, in the period of uterine development, is rounder and higher in other mammals and not only in apes: the conclusion that the mammals are derived from man obviously does not conform to the facts of palaeontology and other branches of biology.

Some twentieth century authors, like E. Dacqué (1935) and Otto Kleinschmidt (1931), have attempted, under the guise of science, to resuscitate Kollmann's ideas. Dacqué even tried to reconcile scientific data on the origin of man with the Biblical myth of the creation of the first man.

With regard to Kleinschmidt: he erroneously regards all fossil men

* Alfred Russel Wallace, *Darwinism*, London 1889, p. 478.

and the Australopitheci as being races of modern mankind; he, furthermore, takes the line of development of other anthropoids far from the human line and links up the apes with a set of types that are alien to man.

The anti-evolutionist, M. Westenhöfer (1935), tried to show that man had descended directly from the lower mammals, by-passing the ape stage. He tried to find support for his hypothesis in the fact that man's kidneys have a complicated structure and consist of almost a dozen renal pyramids. This is, indeed, one of the greatest structural differences that distinguishes man from the apes, monkeys and other Primates.

With regard to this feature in the anthropoid apes it is known that in certain individuals among the chimpanzees as many as seven pyramids have been counted; the gorilla has one and the gibbon up to four; in the orangutan the four pyramids grow together and open into the renal duct by means of a common nipple. The marmosets, macaques, baboons and other Certopitheci of the Old World have one pyramid each. The New World monkeys also have kidneys with one pyramid, although in some of them it is of complex form, having grown out of four to six pyramids.

To refute Westenhöfer's hypothesis it is sufficient to mention the great variation in the number of renal pyramids in man—from three to twenty. The kidney is clearly divided in the foetus stage. The complex pyramidal structure is also found in monkeys. Although the division of the kidneys is very pronounced in man their evolution from the anthropoid type can be shown.

Westenhöfer, a follower of Rudolf Virchow, a German pathologist who opposed Darwin's theory and rejected the view of the Pithecanthropus as the earliest man, is also a fierce anti-Darwinist in his concepts of anthropogenesis. Westenhöfer adopts the position that the essence of the process of anthropogenesis is unknowable and prefers the "poetic-intuitive spirit" to scientific knowledge (Gremyatsky 1932, pp. 182-191; 1937, pp. 136-137.)

The mechanical fusing of science and religion, of evolution and miracles, in explaining anthropogenesis shows how helpless reactionary biologists are in their attempts to reconcile natural science and religion, although such attempts have been made on many occasions in the past and are still being made today.

The reactionary scientist, Franz Koch (1929), for example, says that "Darwinism is a problem in pure science, that is, a problem of the outside world and has nothing whatever to do with problems of our inner world, with questions of religion or philosophical conviction. Only ignorance or intolerance can unreservedly tie up Darwinism with materialism or atheism."

It was only recently (1957) that S. L. Sobol published Charles Darwin's autobiography in full; in this book the great scientist makes his materialist and atheistic views quite clear. Darwin's theory shows that Koch had better look for ignorance and intolerance in himself and in others of his ilk and not in the camp of materialism.

Statements similar to Koch's have been made by B. Bavink (1933) and H. Weinert (1932) who were of the opinion that the question of the origin of man has nothing to do with morals and religion.

All this, however, is nothing more than an attempt to unite two antipodal world conceptions, the idealist and materialist conceptions. Science and religion are incompatible. Religion is based on belief in God, the creator of the universe. The scientific method is based on knowledge of nature and society, on the study of their laws and development.

The bourgeoisie cultivates religion. Reactionary bourgeois scientists, fulfilling the demands of the ruling class, lend their aid to the clergy in defending religion from the blows dealt it by science. Lenin pointed out on many occasions that the exploiting classes need the social functions of religion to retain their supremacy.

The question of the origin of man is not one of abstract science that gives rise to purely theoretical disputes inside the scientist's study. The battles fought around this question, on the contrary, are skirmishes in the class struggle. Suffice it to recall the Scopes Trial in America.

In 1925, in Dayton, Tennessee, a young teacher, John Scopes, was arraigned and tried for having, in contravention of the law on the subject, told the school children about Darwin's theories and his hypothesis of the descent of man from an ape.

In at least fifteen of the United States of America there are state laws forbidding the teaching of evolutionary theories. On March 23, 1925, the Governor of the State of Tennessee endorsed the following law: "Be it enacted by the General Assembly of the State of Tennessee, that it shall be unlawful for any teacher in any of the universities, normal and all other public schools of the State which are supported in whole or in part by the public school funds of the State, to teach any theory that denies the story of the Divine creation of man as taught in the Bible, and to teach instead that man has descended from a lower order of animals." The law was again discussed on its expiration by the General Assembly of the State (1934) and, by the decision of a majority of the members, was prolonged.

The Scopes Trial took place before a huge crowd, many visitors being present as well as local citizens. The chief prosecuting counsel was William Jennings Bryan, a former Secretary of State and presidential nominee: he held the Bible in his hands as the "foundation of life."

The Bible was not much help to him: in his attempts to answer the sarcastic questions of Scopes' counsel—about the whale that is supposed to have swallowed Jonah, about Joshua who ordered the sun to stand still and others—Bryan publicly disclosed his complete ignorance of natural science and history and, incidentally, of the Bible itself.

In the words of Bernard Shaw, the eminent British man of letters, the Monkey Trial had made the American continent the laughing-stock of the civilized world. Despite everything, the class court of the bourgeoisie found Scopes guilty and fined him a hundred dollars.

Religion continues to be the faithful ally of capitalism. The capitalist states give every support to religion and maintain metaphysical philosophy as a means of ensuring their domination. The world that is building socialism bases itself on the philosophy of dialectical materialism, an implacable enemy of religion.

Dialectical and historical materialism are powerful instruments for the transformation of human society: with the building of socialism and then of communism the social and economic base is being fundamentally changed, the world outlook of the working people is undergoing a profound change and they are freeing themselves from the shackles of religion and from the old metaphysical, idealist outlook on the world. The dissemination of a correct understanding of natural phenomena and of society, the process of anthropogenesis in particular, will accelerate the change in philosophy.

2. THE TARSIER HYPOTHESIS

Attempts have been made by some scientists to replace the conception put forward by Darwin and Engels that man has developed from a fossil anthropoid ape by ideas of his descent from other Primates. One of them is the English biologist and anatomist, Frederick Wood Jones, who propounded a detailed hypothesis of the origin of man directly from an ancient Lower Tertiary tarsier.

Fig. 41. Tarsius spectrum Storr.
After E. Boulenger, 1936.

The only living representatives of the tarsiers are tiny animals (fig. 41) living in the East Indies-Malaya area where they are a typical feature of the local fauna. Outwardly the tarsiers resemble the jerboa. They have the huge eyes typical of nocturnal animals, very long hind and very short fore limbs and a long tail that they use not only as a rudder and counterbalance when leaping nimbly from branch to branch, but also as a support when they are resting. The tarsier moves about in a more or less upright position with the

aid of its hind limbs. The calcaneus and navicular bones of the foot are extremely long from which it gets its name of tarsier.

The tarsier hypothesis got its name from these peculiarities. According to Wood Jones the tarsier bears more resemblance to man than man does to the anthropoids. He maintains that the tarsier's upright locomotion is the starting-point for the development of the erect position in man's ancestors.

The only grain of truth in this contention is that the tarsiers bear more resemblance to monkeys than the lemurs do, and there are many scholars who believe that the Old and New World tarsiers were the forerunners of the respective groups of monkeys. They have, for example, a partition between the orbital and temporal fossae while the lemurs have a broad penetrating orifice surrounded by a bone ring (Hill, 1955).

Other features show that the tarsier is more primitive than the lemurs and approximates more closely to the Insectivora; some of these are: the dental system (an anterior cusp on the lower molars, the paraconid, that has been absent in other Primates since the early Tertiary Period) and a big gut of a very simple form. The place of the tarsiers in the phylogeny of the Primates is, therefore, a rather complicated question.

There are two or three species of tarsiers living today. They are the specialized descendants of an extensive group that lived over large areas of Europe, Asia and North America in the early epochs of the Tertiary Period. Many of the tarsiers living at the very beginning of the Tertiary Period, in the Palaeocene, were closer to the lemurs in the structure of the body; they had common ancestors in the insect-eating mammals (Insectivora) of the Upper Cretaceous Period. Some of the primitive tarsiers of the Eocene Epoch were the ancestors of the Old and New World monkeys (Gremyatsky, 1955). It was from the Old World group of monkeys that man's closest ancestors in the shape of bipedal, ground-living, highly developed apes took form in the last epoch of the Tertiary Period. From this fact, however, we must not draw the conclusion that man evolved directly from the tarsiers as Wood Jones asserts.

Wood Jones first put forward his hypothesis in 1916 (cf. Deshin, 1922, pp. 174-182). The hypothesis, however, did not gain support among scholars. In 1929, Wood Jones' second monograph appeared in which he mustered the whole arsenal of his proofs of man's descent from the tarsiers and not from the monkeys. In this monograph Wood Jones made a detailed analysis of the specific nature of the tarsier's structure and compared it with that of man and other Primates. He tried to show, in particular, that all the similarities between man and the apes are the result of parallel development and not of blood relationship as the majority of anthropologists and other scientists believe. He finds that the apes approximate more closely to the lower monkeys than to man.

An important argument put forward by Wood Jones is that the proportions of the human body (short arms and long legs) differ from those that are typical of all apes (long arms and short legs), while the propor-

tions of the tarsier's body are supposedly more reminiscent of man. To these Jones adds the peculiarities of the hairy coat (in particular the distribution of the hairs on the body), the shortened face section of the skull, absence of bones in the penis and clitoris, the peculiar form and structure of the external reproductive organs of the female and other apparent similarities with man.

Wood Jones contends that some primitive features of the human body point to a very distant stage of evolution of those mammals that served him as ancestors: these are the peculiar structure of the collar-bone and certain muscles that are to be found, apart from man, only in such oviparous mammals as the platypus; the structure of man's hands apparently recalls such ancient animals as the amphibians of the Carboniferous Period of the Palaeozoic.

Jones' hypothesis was sharply criticized in his own country and abroad. Some of the data produced by Wood Jones are not in accordance with the facts and others permit of a different explanation. Wood Jones, for example, lays great stress on the shape of the roots of human premolars. It is common knowledge that human premolars have a single instead of a double root as is usual for catarrhine monkeys. The roots of the premolars in the latter are placed side by side along the dental arch whereas when a human premolar has two roots they are placed one on the cheek side of the tooth and one on the tongue side.

The upper premolars of catarrhine monkeys normally have three roots while those of man have one or two or a root that is not fully divided into two; in the latter case the root is in the cheek-tongue position, as Wood Jones particularly stresses. He grants that the position of the roots of the upper premolars in man could be evolved from the dental system of the great apes because two of the three possessed by the latter are in the cheek-tongue position. But still, the lower premolars in man have not been satisfactorily explained because, Wood Jones maintains, the catarrhine monkeys have never had lower premolars with double or with triple roots in the cheek-tongue position such as are sometimes found in man.

In this case Jones is mistaken because this arrangement of roots has been noted in some of the higher catarrhine monkeys.

Lower premolars with triple roots in a chimpanzee have been described in scientific literature. M. Ch. Bennejeant (1936) published a description and photographs of the lower jaw of a chimpanzee with such premolars.

Franz Weidenreich (1937) studied the structure of the premolars and their roots in the Sinanthropus and stated categorically that they are a development of the type of premolar found in fossil anthropoid apes. Gregory (1934) explains the changes in the position of the roots of man's premolars as being due to the shortening of the jaw in the course of anthropogenesis.

The study of the teeth of people and anthropoid apes at the Moscow Institute and Museum of Anthropology showed me the possibility of

still another explanation; the anterior root of the three found in man's ancestors has been lost and the remaining two are arranged across the dental arch. This possibility also contradicts the Jones hypothesis.

There are many other facts that go to disprove the tarsier hypothesis. Contrary to Wood Jones' assertion, the blood of the tarsier is not related to that of man. Between the blood of man and that of the chimpanzee and other apes great similarity, even identity, has been noted. Frederick Tilney (1928) stated in a report on the precipitation reaction that the blood of the tarsier is closer to that of man, the orangutan and the gibbon than to that of the macaque and the American monkeys. This was an obvious error: according to data given by Le Gros Clark (1924) experiments with the precipitation tests for their similarity with human blood, tarsier and loris blood gave negative results—there was no precipitation and no clouding or rings.

Wood Jones lists the following points of similarity between the lower catarrhine monkeys and the anthropoids that distinguish them from man:

1) the nasal bones grow together at an early age;
2) the frontal and temporal bones are closer, especially in the gorilla and chimpanzee;*
3) the upper premolars have three roots;
4) there are noticeable differences in the size of the canines of the two sexes;
5) there is a long bony outer auditory canal (only that of the orangutan is short);
6) in all these monkeys only two main arteries branch off from the arch of the aorta (in the gorilla and the chimpanzee the branched form typical for man is also found);
7) there is a superficial brachial artery;
8) in the hind limbs there is a big saphenous artery;
9) there are highly developed air-sacs (these are not developed in the majority of the gibbons);
10) the majority of kidneys consist of one pyramid;
11) the Simian sulcus is highly developed in the temporal-occipital region of the cerebral cortex.

* The junction of the frontal and temporal bones by means of a suture of some length is called the frontal-temporal pterion. Another type of pterion is typical of the lemurs and tarsiers, the American monkeys, gibbons, the orangutan and man in which the chief contact is between the wing of the parietal bone and the temporal bone—this is the alisphenoid-parietal pterion which has the form of the letter H lying on its side and not standing upright as is the case with the frontal-temporal junction in this region (in many American monkeys the zygomatic bones also form part of the pterion so that it is zygomatic-alisphenoid-temporal). Some scholars connect the character of the pterion area with the development of the temporal lobe in Primates, as being the region of the cerebral hemispheres that is typical for them. In any case the shape of the pterion characterizes the different groups of Primates and is useful in systematics.

To these could have been added the fact that the chimpanzee and orangutan, for example, have (according to Charles Sonntag, 1923) a much less developed system of lymphatic glands than man: the chimpanzee has 21, the orangutan 20 and man 48 groups. There is still another difference in the vascular system that may be mentioned. When the subclavian artery in man enters the upper extremity it is called the axillary and goes deeper into the shoulder than the biggest nerve, the median. The lower monkeys and apes have an axillary artery that is superior to the nerve. This is explained in the following way: in the shoulder of the embryo two blood vessels are formed, one above and the other deeper than the median nerve. As the human foetus develops the superior artery atrophies, and as the monkey develops the inferior artery atrophies.

These points of similarity between the lower monkeys and the apes, however, fall far short of the common structural features that were established by Thomas Huxley for man and the apes and which were briefly expressed in his well-known thesis on their great similarity. Huxley drew the conclusion that the apes are more similar to man than to the lower monkeys. He said: "Thus, whatever system of organs be studied, the comparison of their modifications in the ape series leads to one and the same result—that the structural differences which separate Man from the Gorilla and the Chimpanzee are not so great as those which separate the Gorilla from the lower apes."*

The lower catarrhine monkeys are very specialized animals: they possess ischial callosities and cheek pouches; the four cusps on their molars are joined in pairs by typical transverse ridges. The monkeys have a more primitive brain structure and the vascular system of the brain is differently constructed from that of man and the apes. In the so-called monkey type there is only one anterior cerebral artery that outwardly resembles a basilar artery (a. cerebri basilaris). Man and the anthropoid apes, like the majority of mammals, have two anterior cerebral arteries joined by an anterior communicating artery (B. K. Gindtse and A. M. Fedotova, 1932, pp. 107-112). The points of greater similarity between the lower and higher apes are explained by their common ancestry. The numerous points of similarity between the anthropoid apes and man constitute one of the best proofs that man descended from a species of fossil anthropoid ape.

The facts cited above confirm Darwin's simian hypothesis and disprove the tarsier hypothesis proposed by Wood Jones. The tarsier's shortened face is to a great extent to be explained by the powerful development of the organ of vision and the reduced olfactory organ. The proportion of the tarsier's extremities are less similar to those of man than man's are to those of the lemur or monkey. The tarsier's long tail with its many functions, including that of catapulting it from a sitting position, does not favour the tarsier hypothesis. The tarsier is no bigger

* Thomas Huxley, *Evidence as to Man's Place in Nature*, London 1863, p. 103.

than a rat so that in size it is far removed from the apes. Among the fossil forms of the tarsier known to science there are no middle-sized or big forms, to say nothing of giant tarsiers.

Another fact disproving Wood Jones' theory is that the tarsier is not a gregarious animal. They live either alone or in pairs and are not found in herds such as are typical for many lemurs and almost all monkeys. This is a very important fact for man is, first and foremost, a social being who produces tools and uses them.

The very significant objections raised to the tarsier hypothesis of anthropogenesis propounded by Wood Jones and its obvious contradiction of many facts of comparative anatomy, primatology, palaeontology and anthropology lead us to the conclusion that this hypothesis is completely unfounded (cf. Roginsky, 1948).

3. SOME SIMIAN HYPOTHESES

A number of scholars (Karl Vogt, Florentino Ameghino, Giuseppe Sera) have tried to show that man descended from the American monkeys. Let us examine the platyrrhinian hypothesis of the South American scholar Ameghino. He discovered the remains of skulls of fossil Primates and other mammals including those of ancient man in Miocene and higher strata in South America. On the basis of his study of these remains Ameghino drew up a new genealogy for man in which he included among man's ancestors some of the fossil animals he had discovered.

A critical study of the skulls and bones from Ameghino's collection by other scientists, Hans Bluntschli in particular (1913), led to quite different results. Some of the remains that Ameghino had placed among the Primates proved to belong to other mammals while the true representatives of fossil Primates, such as the Patagonian homunculus, did not differ substantially from some modern American monkeys. Ameghino's hypothesis was completely refuted, although in other spheres of South American palaeontology Ameghino's works proved of great value.

The finding of the Hesperopithecus must also be placed among similar "discoveries" by certain American scholars. The one and only tooth of the Hesperopithecus was found in 1922 by Harold Cook in the Lower Pliocene strata of Wyoming (U.S.A.). The find created a sensation in the scientific world: such prominent American palaeontologists as Henry Osborn, William Gregory and Milo Hellman defined the tooth as belonging to a fossil anthropoid ape, the first discovered on the American continent. Far reaching conjectures on the relationships and the migrations of the Hesperopithecus cooki appeared in the press. One of them, for example, was an article by a well-known British biologist, J. Ellioth Smith, in an English magazine, on the cover of which were depicted a male and female Hesperopithecus who were called "primitive members of the human family" in the article.

A thoroughgoing further examination of the tooth (Gregory, 1927) and fresh finds showed that not an ape but a fossil form of the peccary, the North American pig of the genus Prosthenops, had been discovered.

The reactionary German scientist, Franz Koch, whom we have already mentioned, made original use of the discovery of the Hesperopithecus. In a monograph (1929, S. 164, Karte X) he included a curious genealogy in which the Hesperopithecus was shown as an ancestor of modern man. Since Koch's monograph gave the central place to the North European or Nordic race as being the highest type of human being, he had included that fossil North American pig amongst the ancestors of his Nordic man.

There can be no doubt that extreme caution must be applied to the examination of many theories and hypotheses of anthropogenesis that have been offered in such profusion by reactionary bourgeois scholars. Of course, the possibility of finding the tooth of an anthropoid ape in North America is in itself extremely remote, as it seems that such apes have never existed there. Apart from that, mammalogists know that the molars of apes and swine at times bear close resemblance to each other both in shape and structure.*

The American monkeys, therefore, are not among man's ancestors. It is believed that the aboriginal inhabitants of America arrived there in relatively recent times, no more than 25,000 years ago. Their ancestors most likely made their way there across the isthmus that later became the Behring Strait after the melting of the glaciers. The Red Indians are an ancient branch of the Mongoloid race that first developed in Asia thousands of years before the Europeans.

Certain reactionary bourgeois scientists apparently tried to create plausible proofs of the Indians' descent from a local anthropoid of the Hesperopithecus type. This would be of particular value to the champions of polygenesis—the descent of man from a number of different ultimate ancestors, that is, from different species of apes. In the conception of such anthropologists as Theodor Arldt and Giuseppe Sergi, the human race is not a single species but consists of several species or even genera. Sergi (1911), for example, regards the main human races as genera that include eleven different species and more than forty smaller systematic groups.

It has, however, long been known that the human races, despite their great diversity, are closely related; this can be seen even from the close resemblance they bear to each other. Europeoids may marry Negroes, Mongols and Hottentots, Japanese marry Malays and Polynesians, Negroes marry Mongols. The offspring of such marriages are normal and healthy children who, in their turn, are capable of further propaga-

* The eminent Austrian palaeontologist, Othenio Abel (1931), analysing the specific features of the dental system in Primates even places human teeth among the porcine (suid) type for which rounded conic cusps on the grinding surface of the molars are typical—i. e., they are bunodonts.

tion. Such facts are one of the most important proofs of the fallacy of polygenesis. The human races so approximate each other that up to the present day no substantial differences between them have been found, such as the structure of the brain, the properties of the blood or the functioning of the glands of internal secretion. This proves the correctness of Darwin's theory of monogenesis according to which mankind descended from one species of anthropoid ape and not from several species.

The polygenesists gather together all sorts of scientific and unscientific material for the construction of their race theories. Their hypotheses serve to justify every kind of oppression of the working people of their own and the colonial countries. An outstanding representative of the racists and polygenesists was the reactionary German anthropologist Herman Klaatsch (1922) who expressed the opinion that modern science cannot give its support to that superfluous love of mankind that wants to regard all the lower human races as our brothers and sisters.

A strange attitude is reflected in the works of the reactionary French anthropologist Georges Montandon (1933) who developed and applied to man the hypotheses of the Italian biologist Daniel Rosa (1931) on the origin and development of life on Earth. Rosa says that life began simultaneously over the entire surface of the Earth. It consisted of innumerable minute unicellular organisms of the most primitive organization, but all belonging to one and the same species. The present-day big and small divisions of the animal kingdom are of independent origin. Rosa, furthermore, assumes that living beings appearing in different parts of the world could, by independent development, originate very similar organisms on the different continents.

The extremes to which Rosa goes in his postulates can be seen from his statement that even two men from the same village may have nothing in common, not only from the time of man's appearance, but even from the moment of the origin of life on Earth.

Montandon, in applying Rosa's hypothesis to man, said that people appeared on the continents independently of each other and, consequently, are not connected with each other by any bonds of relationship. Montandon even tried to prove that in America, also, man could have originated from an American anthropoid ape.

In his search for confirmation of his hypothesis, Montandon came across the report of an interesting adventure related by the geologist, Francis de Loys. It occurred in South America in 1920. When they were journeying through an extensive tropical forest on the borders of Venezuela and Ecuador, de Loys and his companions were attacked by two huge monkeys.

De Loys describes the event as having taken place on the bank of a river. Hearing a loud noise the travellers ran out of their camp. Two rather big monkeys, screaming and breaking branches that got in their way, came running towards the camp. The travellers allowed them to get

close and then fired and killed one of them, a female (fig. 42). The other monkey was wounded but fled and hid in the dense forest (de Loys believed it to be a male). The dead monkey was placed on a box and photographed. Although de Loys maintains that the monkey was tailless it cannot be seen from the photograph whether this is true or not. Apart

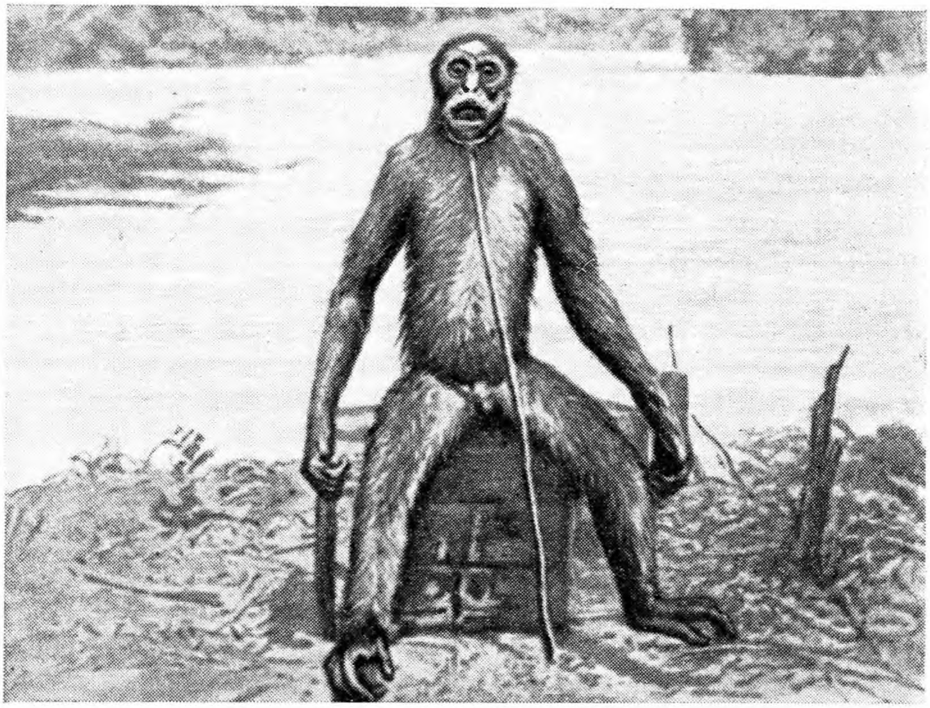


Fig. 42. Ameranthropoides loysi Montandon.
After F. de Loys, 1931.

from that, it is difficult to believe from the photograph that the female was 160 cm. tall, as he asserted.

De Loys took the skull, lower jaw and skin with him. Unfortunately the skin got lost on the long and difficult expedition as did also the lower jaw (which was supposed to have contained 16 teeth and was kept by de Loys, as head of the expedition). The skull got into the hands of the cook who kept salt in it; through the action of the salt in the damp climate the skull fell to pieces and was thrown away. And so the only document left was the photograph of the monkey and the description given by de Loys.

Montandon rescued de Loys' story from the limbo to use as proof of the truth of the ologenesis hypothesis that treats of the independent origin of man in America. He maintained that the female killed by the expedition was a real American anthropoid ape: the big dimensions of the body, the absence of a tail and the human features of the face all served Montandon as positive argumentation.

After a communication made by Montandon to the Paris Academy, articles on the Ameranthropoides loysi appeared in several journals. An article by de Loys was also published in support of the ologenesis hypothesis. A number of critical articles also appeared. It all resulted in the Ameranthropoid being defined as nothing more than a big spider monkey (Ateles), perhaps even a representative of a new species of that animal. The female killed had only four fingers on each hand and the thumb was atrophied like that of the spider monkey; its face also resembled that of the latter animal. The nose partition is broad like that of most American monkeys. The body and the limbs are slender. Most likely the animal had a long, prehensile tail that must have been hidden behind the box. According to Montandon and de Loys the height when seated was about 70 cm. which is not much more than the height of the spider monkey when seated (up to 65 cm.) (Nesturkh, 1932).

From the sum of evidence we must conclude that the ologenesis hypothesis suffered a further defeat in this case. Other facts cited by Montandon in support of ologenesis can be given other explanations (Gremyatsky, 1932 and 1934).

Rosa's ologenesis hypothesis is based on the mechanistic assumption that the spontaneous development of species can take place only by dichotomy, or division into two branches, the earlier and later. Of these the earlier, according to Rosa, is not usually divided any further and in the end becomes extinct; the later has chances of further development, again by dichotomy, and progresses, evolves.

Dichotomy, however, is an absolutely arbitrary concept: one species may serve to originate a large number of subspecies or varieties and not merely two. Of the eight modern races that Montandon lists, the European, Mongol and Negro races are, in his opinion, the late-comers, that is, they are capable of further evolution and perfection. All other races belong to the earlier branches and, he says, are doomed to extinction.

The ologenesis hypothesis, therefore, is nothing more than a veiled, pseudo-scientific excuse for colonial oppression and is clear enough proof of definite tendencies in the work of reactionary bourgeois scientists. Montandon's hypothesis is fundamentally unacceptable to Soviet scientists.

The next group of anthropogenetic hypotheses consists of those that treat of the descent of man from a group of Old World monkeys: these are known as catarrhine simian hypotheses to distinguish them from the platyrrhine. There are very few biologists who claim that man is descended from the group of lower monkeys with their quadrupedal or pronograde means of locomotion, tails of varying lengths, cheek pouches and ischial callosities, although quite recently the Proconsul has been included among man's ancestors.

The authors of simian hypotheses usually begin an analysis of the living anthropoid apes to decide which of them has the most significant signs of relationship with man. This approach has provided gibbonoid,

orangoid, gorilloid and chimpanzoid hypotheses as well as those that are a combination of several of these.

Supporters of the gibbonoid hypothesis, for example, take as their starting-point the fact that the Propliopithecus, a species that apparently had gibbonoid features, produced the Pliopithecus and through it the gibbons; the Propliopithecus, however, was the common ancestor of the other anthropoids as well, and, therefore, of man (Gregory, 1933). The idea of the gibbonoid phylogenetic connections of man has also been propounded by the palaeontologist Guy Pilgrim (1925), and the anthropologist Hans Werth (1928).

Man's bipedal method of locomotion, however, developed under circumstances differing from those in which the gibbon developed. The latter, with his long arms, does not move in the upright position on account of his terrestrial way of life, but because he is arboreal and brachiating habits have given his body its upright position. Man did not pass through the stage of superspecialization, like the gibbon; such a stage would have had a more pronounced effect on the proportions of his limbs in the uterine period of development and in later periods of his life.

Supporters of the gibbonoid hypothesis (among whom, in particular, are some representatives of the Johns Hopkins University school of anatomists in the U.S.A.) point to the fact that the gibbon, more than other apes, resembles man in certain of its features—the position of the internal organs, the thorax with a dorso-ventral diameter that is less than the transverse diameter and a very wide and short sternum, strongly-developed great toes and thumbs, the smooth outer surface of the cranium, the shape of the molars and the structure of the lower jaw which, in the syndactylian gibbons or siamangs, has a comparatively well developed chin with an initial chin ridge (protuberantia mentalis).

There are, however, such specific features of the gibbons as the small size of the body, the more primitive brain, the absence of frontal cavities, the free central bone in the wrist, the ischial callosities that all go to show, according to Gregory and others, that the group of extinct gibbons cannot be taken as the point of departure for the study of man's descent.

A peculiar variant of the gibbonoid hypothesis was produced by Adolf Schultz (1936) who believes that the gibbons and man approximate each other in a number of important features more closely than man and the big anthropoid apes. The ancestors of the hominids and gibbons, says Schultz, branched off from the main trunk of anthropoid higher Primates even earlier than the ancestors of the orangutan, together with the gorilla and chimpanzee, left the main stem of big anthropoids. Man's great approximation to and relationship with living and fossil anthropoids make Schultz's gibbonoid hypothesis unacceptable.

Some scholars have propounded the hypothesis that man descended from the orangutan. Herman Klaatsch (1922) said that the Aurignacian man derived from the orangutan and the Neanderthaler from the gorilla. Somewhat later (1926) Hans Friedenthal pointed to the relatively high

skull of the orangutan as proof of the "similarity" of that ape with members of the Mongoloid race.

The long-armed orangutan, however, must be crossed out of the list of man's closest relatives on account of many signs of specialization, such as: the cheek-pads of the males; reduction of the great toe which has no nail; bare patches with hard skin in the regions usually occupied by ischial callosities; the lungs are not divided into lobes; deep furrows in the enamel of almost all the teeth; no uvula attached to the rear of the soft palate; a concave, "bulldog" type of profile known as symognathous that is to a lesser degree typical of the chimpanzee; they both differ from the gorilla, the latter having a regular profile and facial part of the skull; the wavy character of pigment distribution on the cross-section of the orangutan's reddish-brown hair (the corrugated edge of the pigment layer); huge throat pouches; an enigmatic sternal gland found in embryos and young individuals, especially males.

As far as the gorilla is concerned, some scholars, Sir Arthur Keith, for example, are inclined to accept that huge anthropoid as man's closest relative. The gorilla's brain is bigger and of a more complicated structure than that of the chimpanzee or orangutan. Some of the features of the male genitals of the gorilla and man are astonishingly similar and the sex cells of the gorilla are extraordinarily like those of man. The structure of the skull of the female gorilla is, according to Weidenreich (1943), closest to what is believed to be the skull shape of Pithecanthropus' immediate ancestor.

There are, however, serious objections to the gorilloid theory of anthropogenesis, since the skull of the male gorilla with its powerful ridges places this powerful ape and his immediate ancestors in a branch that is more likely to be parallel to man's on the genealogical tree. The gorilla's blood produces a lesser precipitation reaction than that of the chimpanzee or even the gibbons, although the clot is greater than that of the orangutan, which in this respect is closer to the catarrhine monkeys of the baboon type.

The most widespread simian hypothesis of anthropogenesis is the chimpanzoid. Such prominent scholars as Gustav Schwalbe, William Gregory, Hans Weinert attribute to the Dryopithecus and later Upper Tertiary ancestors of man, features that approximate them to the chimpanzee. There are features of astonishing resemblance in the structure of the cerebral hemispheres of the chimpanzee and man. In general the chimpanzee shows signs of far less specialization. There are no great differences between the sexes such as the gorilla or the orangutan display. Gregory (1933) even called the chimpanzee a "living fossil."

When we speak of man's closest relatives, it is quite obvious that the accumulation of anatomical and physiological data on anthropoids and man does not affect Darwin's thesis on the close relationship of man and the African anthropoids. Attempts to upset that thesis, however, are being made even today.

Many bourgeois scientists do their best to rid man's genealogy not only of the anthropoids but of all Primates, and depict the ancestor of man not as a tree-dweller but as a tiny bipedal, terrestrial man, the Eoanthropus, or Dawn man, who is supposed to have derived directly from primitive lower mammals somewhere in the depths of the Tertiary Period. Marcellin Boule (1946), who does not deny man's relationship to the apes, describes this mysterious ancestor of man, unknown to science, as a tiny representative of the human family that held its body in a more or less upright position, had an enormous cranium and, consequently, a brain that was very big in comparison with the size of its body. Boule does not accept the Dryopithecus as an ancestor of man. The view that a Tertiary man existed is expressed by Osborn in a hypothesis close to Boule's Eoanthropus hypothesis.

4. OSBORN'S HYPOTHESIS

The very prominent American palaeontologist Henry Osborn (1857-1935) is an outstanding representative of those reactionary bourgeois scientists who try to reconcile science with religion by their declaration that the creation of the organic world is effected by means of purposeful evolution. The metaphysical formula of "creation through evolution" is very popular among certain American biologists.

Osborn assumes that the Tertiary progenitors of man in the form of Eoanthropi, or Dawn men, had almost all the qualities possessed by modern man. According to his thesis the ancestors of man had no connections with the ancestors of the apes, i.e., man does not derive from the monkey group; man first developed in Inner Asia and his ancestors led a terrestrial life. Osborn admits the existence of man not only in the Pliocene but even in earlier epochs of the Tertiary Period.

Osborn's theses are of a purely hypothetical nature and are not founded on facts. His ideas emerge from the fallacious premises of the aristogenesis hypothesis which, too, was his own creation. Osborn postulates that evolution does not take place so much through natural selection or under the influence of the environment as on account of the miraculous ability for spontaneous progressive development that is inherent in the organism. Osborn's hypothesis is in complete contradiction with everything, including the data that prove the relationship of man to the living apes and the known extinct apes to fossil man. Equally unfounded is his attempt to find evidence of the existence of Tertiary man in the "Tertiary eoliths," or stones having the appearance of primitive weapons.

Osborn's views on the problem of the origin of man underwent considerable change in the course of his many years of work in the spheres of palaeontology, general biology and anthropology. Osborn himself admitted that up to 1923 he had fully shared the view that the human race derives from one of the species of fossil anthropoid apes in accordance with Darwin's theory of evolution. As a palaeontologist, however, he had

his doubts about the monkey theory of anthropogenesis. His doubts were expressed in the following three points: 1) the proportions of the limbs of fossil men are not anthropoidal but completely human, the lower limbs of the Pithecanthropus and the Neanderthaler are long and the upper limbs of the latter are short; 2) the structure of the hand of the Neanderthaler is fully human, the thumb is no less developed than that of a modern man and the fingers are no less flexible; 3) certain flint weapons, for example those found at Red Crag (south-east coast of England), have an antiquity dating back 1,200,000 years.

From this Osborn goes over to an acknowledgement of the extreme antiquity of man whom he perceives as a creature with a straightened erect body and who is capable of work and of art, i.e., who is already highly developed. His journey with Charles William Andrews to the Gobi Desert served as an impetus to Osborn's elaboration of the eternal character of the human type with its original habitat in Mongolia and Tibet. During the expedition to Mongolia with its mountain plateau landscapes and abundance of strange, extinct giant reptiles, Osborn conceived the idea that it was precisely here that the cradle of man was to be found; he pictured it as a region with winding streams and scant forests alternating with grassy plains (1929). It was precisely in such a region, reasoned Osborn, that quadruped and biped mammals could develop rapidly and among them were the ancestors of the so-called "ape-men." Here they could easily keep the environment under observation, take cover from their enemies in good time and had stones close at hand for use as weapons.

Some years prior to Osborn a similar idea of man's original home in the form of a semi-arid plateau was propounded by the American palaeontologist, Joseph Barrell, but Osborn insisted that he arrived at his hypothesis independently. Osborn first published the hypothesis in 1923. In the years that followed he frequently returned to different aspects of the problem of anthropogenesis. Finally, in 1929, Osborn developed his hypothesis into a widely based theory of the semi-arid plateau in a paper he read at a congress in honour of the 200th Anniversary of the American Philosophical Society.

Speaking of the original home of mankind and of the assumed ecological conditions of life of man's ancestors, Osborn conducted a polemic against Darwin's contention that it must have been a country with a warm or hot climate covered with forests. Contrary to Darwin's opinion, Osborn maintained that man, already adapted to orthograde locomotion, could not have developed further if he had been surrounded by tropical forests where he would not have been able to find material for the manufacture of stone weapons. As proof of the truth of his views, Osborn put forward the concept that progressively intellectual and independently adaptive types of man could take form on a level plateau, such as are found in Mongolia and Tibet (cf. P. P. Sushkin, 1928).

Tertiary man's inventiveness in methods of acquiring food must, according to Osborn, have been produced by the fact that there was little vegetable food and game in sufficiency. The extreme difficulty and sharpness of the struggle for existence under such natural conditions, said Osborn, must have served as a strong impetus to use wooden and stone weapons for the hunt. Furthermore, the severity of the climate on a mountain plateau compelled the most ancient hominids to make use of fire for warmth and for the cooking of food. The hunting of wild animals must have developed the strength and agility of the legs, the organ of sight and the lungs of man's ancestors. This is how Osborn pictures the ecology and way of life of the Dawn men.

Now let us examine the physical type, structure and behaviour of Osborn's Tertiary men who lived earlier than the Pithecanthropi. He believed the Pithecanthropus to be a type that had been caught in the cul-de-sac of evolution, a relic of a more ancient form of man, the remnant of a group that had been driven out of the southern part of the Asian continent by more progressive hominids to live under island conditions in Oceania. In Osborn's opinion the following were the characteristics of the Eoanthropus acquired millions of years ago:

1) progressive intelligence, rapid development of the forebrain;
2) bipedal habit and development of the walking and running type of foot and big toe;
3) shortening arms and lengthening legs;
4) development of the tool-making thumb;
5) tool-making capacity;
6) adaptation and design of implements of many kinds in wood, bone and stone;
7) design and invention directed by an intelligent forebrain;
8) use of the arms and tools in offence, defence and all the arts of life;
9) the use of the legs for walking, running, travel and escape from enemies;
10) tree climbing by embracing the main trunk with the arms and limbs after the manner of the bear.

The following are typical features, according to Osborn, of the ancestors of living apes:

1) arrested intelligence and brain size;
2) arboreal to hyper-arboreal quadrumanal habit—living chiefly in trees;
3) quadrupedal habit when on the ground;
4) lengthening arms and diminishing legs;
5) loss of the thumb and absence of tool-making power and development of the grasping power of the big toe for climbing purposes;
6) limb-grasping capacity of the hands;
7) adaptation of the fore and hind limbs to the art of tree climbing and brachiating;

8) design limited to the construction of very primitive tree nests;
9) use of the arms chiefly for tree climbing purposes, secondarily for the prehension of food and grasping of the foe;
10) use of the legs in tree climbing and limb grasping;
11) escape from enemies by retreat through branches of trees;
12) tree climbing always along branches, never by embracing the main limbs and trunk.

Thus we see that Osborn draws a sharp line between men and the anthropoid apes and not only the living species but also the ancient Tertiary species. In this way he tries to undermine Darwin's theory of the descent of man from the group of Old World monkeys. Osborn's anti-Darwin anthropogenetic hypothesis is based on the biological theory of aristogenesis that he developed and defended throughout half a century of scientific work.

It is quite reasonable to ask what connection there is between Osborn's hypothesis of anthropogenesis and his theory of aristogenesis. The link between them is organic and unbreakable; the former is part of the latter. By the law of aristogenesis or rectigradation, Osborn understands the gradual, in the course of many centuries, appearance of new adaptive features in an organism that occur in the embryonic plasma and at the early stages of development are quite independent of natural selection.

In his monumental work on Proboscidea (1936), published posthumously, we read the following: "From the author's prolonged thirty-five-year research on Titanotheres and Proboscidea there issue not only the principles governing the classic modifying modes of evolution known to Lamarck and Darwin (variation, development, degeneration) but also the newly discovered and hitherto unrecognized principle and modes of the origin of new characters through aristogenesis or creative biochemical rectigradation."* It is on this principle of rectigradation that Osborn bases his explanation of the evolutionary process which, he maintains, is of a purposeful, "creative" nature.

The following example will give us some idea of the idealist nature of Osborn's views on the evolution of the animal kingdom, views that resurrect the idea of the psychological creation of animals. In his study of a series of skulls belonging to young and adult Titanotheres, Osborn (1912) found that their horns emerge in a definite, predetermined manner. Osborn examined a group of heads and skulls of modern bovines and established the fact that before the appearance of bony elements at the points where the horns grow, rounded thickenings of the skin with an intense growth of hair and an accumulation of keratin make their appearance. In connection with this Osborn poses the question: which made the earlier appearance, the psychic impulse to use the horns, the epidermal keratin protection of the bony centre of the horn or the horn itself? Osborn's reply to his question is amazing:

* Henry Fairfield Osborn, *Proboscidea*, New York 1936, Vol. I, p. XIV.

it seems, he says, that the psychic tendency must have preceded the epidermal and that the latter anticipates the bony growth.

From this it follows that Osborn's evolutionary views are based on an undisguised idea of autogenesis. He is an orthogeneticist insofar as he admits in organisms a hidden, predetermined tendency to development in one direction or another. Spontaneous changes in the embryonic plasma that are of an adaptive nature in respect of future changes in environment from the moment of their occurrence are, according to Osborn, the orthogenetic "biological features" that develop independently, purposefully and consistently. Not confining himself to the introduction of the "creative" element into the concept of rectigradation, the author of the aristogenesis theory adds a further element of "improvement": he gives the rectigradations the new name of "aristogenes," meaning better heredity and, simultaneously, better adaptation of the organism to the life that lies before it. Osborn's views on evolution, therefore, have a clearly defined teleological character—a creative evolution taking place in the world of organisms that is directed towards a definite goal.

On the strength of his half century of work as a scientist and popularizer of science Osborn placed a high value on his scientific and philosophical views. In the above-mentioned monograph on Proboscidea he says: "Through the clear distinction between change of proportion (alloiometry) and the origin (aristogenesis) of new parts, also through the newly discovered multiple lines (forty-one or more) of ancestry and ascent technically known as phyla, the Proboscidea afford a complete revolution in our biological philosophy and concepts of the nature and causes of evolution."* In other places in his monograph Osborn finds it possible to apply to man the same biological laws or factors as he does to his elephants, without any regard for the powerful influence of social factors on the formation of mankind, a qualitatively specific process when compared with the evolution of the whole remaining world of living beings on our planet.

In trimming his hypothesis of the origin of man to fit the general biological theory of aristogenesis, Osborn not only makes methodological and factual mistakes, he even goes further than his theory of aristogenesis requires. Osborn's main postulate is that the ancestral form of man must have possessed 100 per cent of the specific features and potentialities for development that are found in his successors. Here, however, we have nothing more than a different formulation of the old preformation views asserting that future generations are built up in those preceding them. Osborn's thesis, therefore, is a purely metaphysical construction. Why did Osborn resurrect preformation? Apparently he thought it important to draw the lines of the evolution of the apes and man as far apart as possible, to reduce the obvious contra-

* *Ibid.*, p. XV.

diction between the scientific conception of anthropogenesis and the religious myth of God's miraculous creation of man "in his own image" as related in the Bible.

Being unable to refute the many facts that go to prove the blood relationship and close anatomical, physiological and psychological approximation of man and the apes, Osborn preferred to stick to palaeontology where he feels himself to be an authority. As a basis for his theoretical views he perceives man's Tertiary ancestor, as we have already mentioned, in the form of the Dawn man, a small, bipedal, terrestrial, anthropoid primate with limbs of protohuman proportions, a big brain and a comparatively well-developed intellect. The Dawn man had not experienced the arboreal phase of evolution except, perhaps, for a short sojourn in the trees at the beginning of the Tertiary Period. Osborn even comes close to picturing the Dawn man with a form similar to some kind of ground-living tarsier of the Eocene Epoch—anything to get man further away from the apes. His Dawn man branches off from the common stem of the Primates' genealogical tree as early as the Oligocene Epoch and does not link up with the anthropoid apes. Osborn explains man's similarities with the latter by parallelism and analogous adaptation that is supposed to have occurred during the process of development of man, all apes and some of the lower monkeys.

One cannot help but see the connection between the aristogenetic hypothesis of the Dawn man and the tarsier hypotheses. Wood Jones also explains the similarities of man and the apes as homoeomorphism or similarity of form such as we observe in the New and Old World monkeys that have many similar features but, apparently, developed independently of each other on widely separated continents for tens of millions of years. But this outward resemblance of which Wood Jones speaks is of an incomparably more distant analogical character, while the similarity of man and the apes belongs not only to the category of homology, but is only to be explained by phylogenic relationship. Numerous palaeontological and palaeanthropological facts prove the correctness of Darwin's hypothesis of anthropogenesis.

Darwin's view that the Dryopithecus was the common Miocene ancestor of the gorilla, the chimpanzee and man has stood up to the test of facts for almost a century. The discovery, furthermore. of the Ramapithecus and the Australopithecoid African anthropoid apes has thrown light on the morphological peculiarities of the Pliocene anthropoids that are close to man genealogically. The discovery of the teeth of the fossil anthropoid Udabnopithecus by the Soviet scientists N. I. Burchak-Abramovich and E. G. Gabashvili in Georgia (1939) serves to confirm the wide geographical distribution and the great variety of form and structure of apes that approximate to man. Lastly, the latest discoveries of the fossil bones of gigantic Pliocene and Pleistocene anthropoids (the Gigantopithecus blacki in South China [1935] and the Meg-

anthropus palaeojavanicus in Java [1943], for example) show that anthropoids approximating man's ancestors also lived in South-East Asia.

There is, therefore, no doubt that the Neogene was rich in its variety of great anthropoids of which quite a large number were close to the later developing first men, the Pithecanthropi. The idea that the most ancient representatives of the human race emerged from this group of similar forms now has a firm enough foundation. It does not follow from this, however, that we may accept either the Gigantopithecus or the Meganthropus as our ancestors in the way Franz Weidenreich (1945) does in his Gigantoid or degeneration hypothesis of anthropogenesis. Like Osborn he adopts the orthogenesis theory of the evolution of the Primates and man as opposed to the materialist theory of Darwinism.

In his examination of fossil anthropoids and hominids, Osborn tries to squeeze the earliest men and the Neanderthalers out of the human genealogy: he takes the line of descent of the Dawn man directly to a modern type of man whose antiquity he exaggerates.* The support which Osborn found for his theory in the fossil bones of Dawson's Dawn man found in England in 1908, 1911 and 1915 has been deprived of all scientific verisimilitude in view of later information that caused some of the bones to be discarded: the lower jaw proved to be that of a modern chimpanzee (or orangutan) that had been artificially coloured. Thus, the discovery of the Dawn man, that Soviet anthropologists always regarded as dubious, proved to be a falsification (Roginsky, 1951; Gremyatsky, 1954).

Osborn bases his assumption of the ancient skill of man's ancestors on the contention that there exist Tertiary eoliths. The eoliths from Red Crag that he mentions are by no means as ancient as he supposes. Apart from that, it is often difficult to distinguish artificially-made stone weapons from natural stones that have been shaped by breaking and by blows against other stones in avalanches or in some raging whirlpool. Nevertheless, it is quite probable that some of the Quaternary eoliths owe their shape to the first men who, in addition to man-made weapons, also made use of unfashioned stones, selecting the most suitable and trimming them very slightly.

We cannot reject all the Quaternary eoliths merely because stones of a similar shape have also been found in the Miocene Epoch, as it is highly probable that the first man-made weapons were barely distinguishable from natural stones.

---

* An outline and criticism of Osborn's hypothesis are to be found in my works: *Osborn's Hypothesis of Anthropogenesis and its Criticism* in *Uspekhi sovremennoi biologii*, 1940, Vol. XIII, issue 2, pp. 347-353; *Osborn's Orthogenetic Hypothesis of the Origin of Man and its Criticism* in *Yestestvoznaniye v shkole*, 1948, No. 3, pp. 3-7. See also obituary in *Antropologichesky zhurnal*, 1936, pp. 371-375 in which his reactionary ideas on anthropology are discussed.

The tools of the ancient Chinese man, the Sinanthropus, show that they must have been preceded by others of still simpler form and among them there might have been eoliths.

Osborn's aim, however, was to use his legend of the "eternal" nature of the ancient craftsman to reconcile in some way or another science and religion precisely in the field of anthropology. It is not surprising that such "scientific" constructions meet with the sympathy of the clergy.

The most important task facing the theologians is not to permit recognition of the fact that man developed naturally from his predecessors, the apes, and in every possible way to cut man off from the remainder of the animal kingdom, even from those forms that are actually, by the structure of their bodies, obviously to be regarded as men. This is all done in order to be able to affirm the immortality of the soul which God is supposed to have breathed into the first man at the moment of his miraculous creation. Furthermore, the theologians give their support to the unscientific tendency to prove that modern man is of greater antiquity than even the Pithecanthropus, from which it follows that man did not descend from the apes. It is, therefore, much easier for them to declare modern man to be of extreme antiquity and to have made his appearance independent of the animal kingdom, i.e., by the performance of a miracle. All such attempts, however, lose more and more ground with each new discovery.

In order to give their writing a similitude of science, the theologians make good use of the works of reactionary biologists and other scientists. In their search for proofs to be used against the conception of evolution as a process that proceeds exclusively according to natural laws, the theologians adopt any of the hypotheses propounded by idealistically-minded bourgeois scientists that elaborate the theory of evolution as the unfolding of a divine plan of creation.

Hypotheses which base evolution on the eternal combination and recombination of the same unchanging hereditary particles, the genes, are of great convenience to the theologians. As an outstanding representative of this trend in bourgeois biology we may name Jan Lotsy (1927): he applies to man the anti-evolutionary theory of organisms as a combination of genes. The mechanistic character of Lotsy's conceptions, related to Osborn's gene mosaic, may be seen from the following statement: "It is important, even if species are immutable, that evolution should, at least, be reasonable. And my hypothesis has a complete analogy in lifeless nature: the genes correspond to the elements and the chromosomes to constant chemical compounds."

Lotsy's hypothesis of anthropogenesis turns man into an accumulation of unchanging genes and leads to idealist views on the human races; it is scientifically unsound, contradicts Darwin's conceptions of anthropogenesis and, in fact, leads to the idea that the human type is essentially unchangeable.

5. WEIDENREICH'S HYPOTHESIS OF ANTHROPOGENESIS

Franz Weidenreich, a prominent German anthropologist, for many years elaborated the autogenetic theory of evolution in its application to the animal kingdom in general and to man in particular. We shall now analyse Weidenreich's hypothesis. According to Weidenreich the whole course of human evolution, insofar as it is revealed by the dental system, is a typical case of orthogenetic development that affects every system of organs and the structure of the body as a whole by transforming them in one and the same direction. In conformity with his idealistic views on evolution, Weidenreich maintains that everything that has happened to the dental system is merely the result of general changes to the body and cannot be the result of any direct or accidental effect on the teeth such as, for example, changes in the method of feeding or the selection of indefinite accidental variations. In the light of Darwinism, however, not only Weidenreich's idealistic hypothesis of evolution but also his views on the orthogenetic course of the evolution of the hominids as a physical type and of their ancestors are unfounded.

Weidenreich tries to prove that changes in the physical organization of living beings are of a spontaneous nature and take place because of an inner tendency to develop. Such reactionary views are nothing more than a return to the theory of life forces, in other words, an attempt to hold out a hand to religion, and have nothing whatever to do with Darwin's materialist theory. We have already seen that changes in the method of feeding and external factors have a real effect on the evolution of the skull and teeth of the Primates.

The gigantoid hypothesis of the origin of man, proposed by Franz Weidenreich in 1945, would seem to be the most soundly argued of the idealistic hypotheses of anthropogenesis. Its factual basis is the fossil remains of huge anthropoids found in South-East Asia. Weidenreich regards them as hominids, as the most ancient representatives of the human race. Weidenreich's main idea is that gigantism is a typical feature of man's more immediate ancestors.

He gives first place to the Gigantopithecus blacki, so named after the English anatomist Davidson Black who is well known for his Sinanthropus researches. The new genus of fossil anthropoids was established in 1935 by G. G. R. von Koenigswald on the basis of a badly worn tooth, a lower right end molar (fig. 43). This tooth has an interesting history. Koenigswald did not find it in the earth but acquired it in the shop of a Chinese apothecary in Hongkong from whom he also purchased about fifteen hundred teeth belonging to fossil orangutans. Judging by the teeth and bones of other fossil animals together with which the teeth were on sale either for the preparation of medicines or for use as amulets, the orangutan teeth came from some caves in Yunnan and Kwangsi in South China and are of comparatively recent,

Pleistocene, origin. Koenigswald later found among the orangutan teeth he had bought two huge molars belonging to a Gigantopithecus (the last lower left and first upper right molars) and still later another.

The length of the crown of the lower Gigantopithecus molars is 22 and 22.3 mm., that of the gorilla is 18-19.1 mm. and of modern man 10.7 mm., i.e., almost half the size. The crown of the Gigantopithecus tooth averages 4,420 cu.mm., that of the gorilla 2,356 cu.mm., i.e., about one half. Since the crown of man's third lower molar has a volume of only 723 cu.mm., that of the Gigantopithecus is six times greater than that of man.

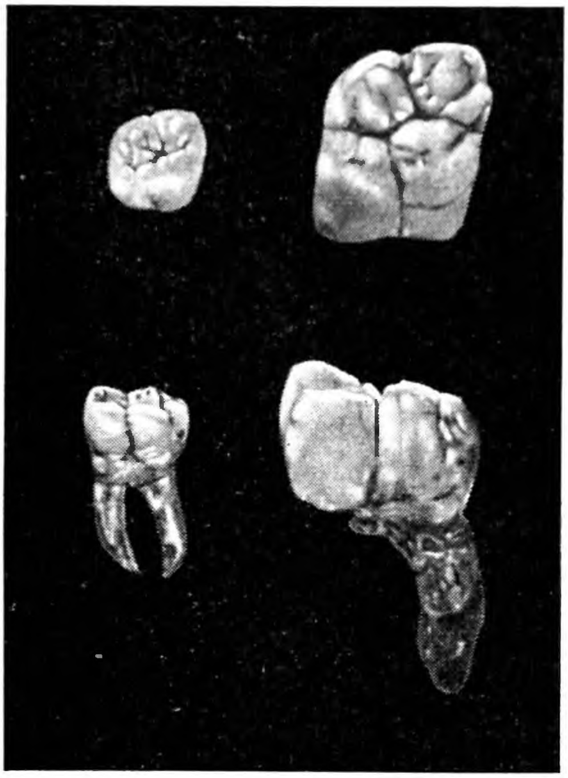


Fig. 43. The upper and lower molars of man (left) and Black's Gigantopithecus; superior and vestibular aspects.

$^6/_5$ natural size. After G. Koenigswald, 1947.

Now let us look at some other peculiarities in the shape and structure of the Gigantopithecus teeth and point out those that, in our opinion, contradict Weidenreich's assertion that the South Asian giant representatives of the ape world belong to the human species. Take the proportions of the crown: the rear section of the lower molar, the talonid, is narrower than the front section, the trigonid, which in the ancestors of the monkeys has a triangular arrangement of the cusps—the paraconid, that in the majority of the Primates has disappeared, the protoconid and the metaconid. In this important point the Gigantopithecus clearly approximates the anthropoids more closely than it does the hominids who, as a rule, have teeth with the talonid wider than the trigonid. Other signs confirm this, such as the supplementary cusps on the grinding surface of the lower molars. Here we must make special mention of the so-called sixth cusp situated on the inner posterior edge between the entoconid and the hypoconulid that is so typical of the Dryopithecus to which the Gigantopithecus shows relationship in the distribution of the main cusps. Lastly, the third lower molar of the Gigantopithecus shows no signs of the reduction that is typical of the last molars, or wisdom teeth, of hominids. Koenigswald admits that the Gigantopithecus can even be approximated to the Sivapithecus, i.e., to a group that is closer

to the ancestors of the orangutans, an opinion that is probably closer to the truth than Weidenreich's hypothesis.

In any case Weidenreich's thesis that the Gigantopithecus is not an anthropoid but a typical hominid, has to be completely rejected as having no scientific foundation.

The Gigantopithecus is neither a hominid nor an ancestor of man. The huge skull of the Gigantopithecus was probably bigger than that of modern man. Judging by the recent find of three lower jaws with a full set of teeth (Pei Wen-chung, 1957) the skull of the Gigantopithecus had arough outer surface. The tremendous strength of the Gigantopithecus gave him superiority in the interspecies struggle—he had no need to recourse to weapons for aid. He hunted animals and carried parts of their flesh to the caves in which he lived. There are, however, no data from which we might assume that he was capable of developing into a human being.

Weidenreich's second argument is the find of a fragment of the lower jaw of the ancient Javanese Meganthropus (fig. 44), which one of

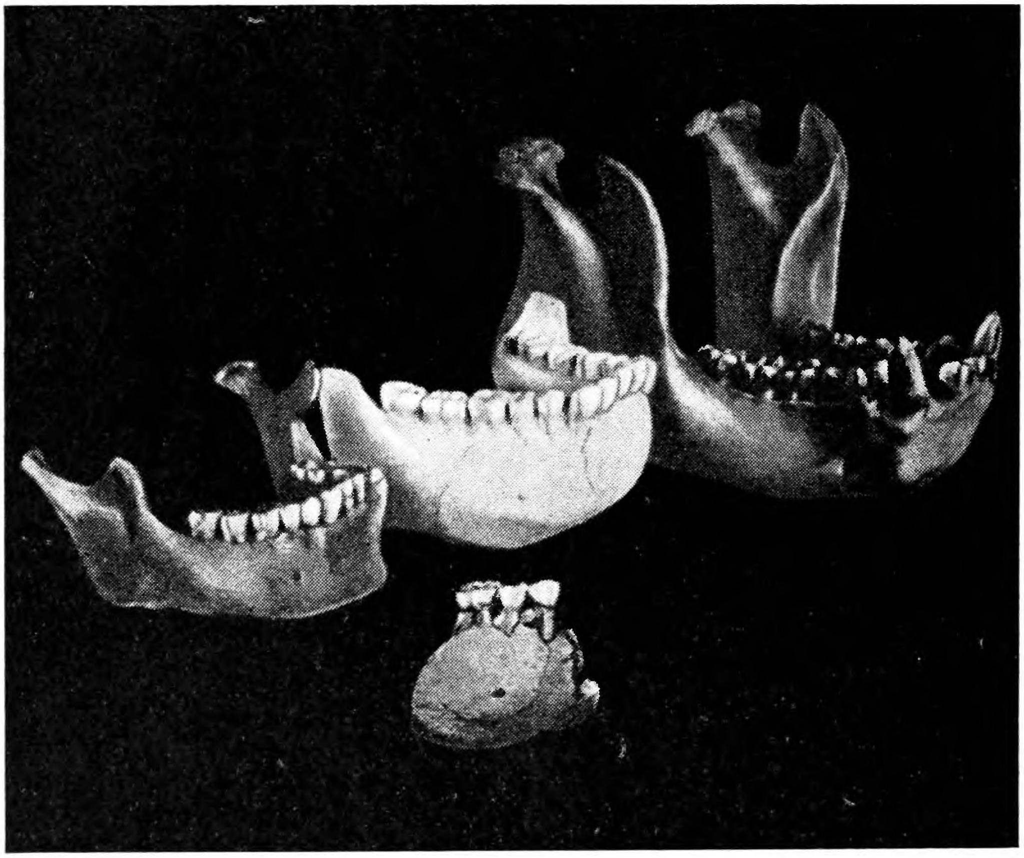


Fig. 44. Meganthropus palaeojavanicus Koenigswald; fragment of mandible, right aspect. Above—reconstructed by F. Weidenreich with human (left) and gorilla (right) mandibles.

$^{2}/_{7}$ natural size. After G. Koenigswald, 1947.

Koenigswald's collectors discovered in 1941 in a hollow caused by a geological fault at Sangiran on the island of Java. The fore middle section of the right half of the body of the jaw (ramus horizontalis dexter corporis mandibulae) had been preserved. The dimensions of the fragment and the teeth indicate that its owner was a being with an extremely big body: the height of the fragment at the level of the chin foramen was 48 mm. while that of the gorilla between 39 and 49 mm. The first molar, two premolars and the socket of the canine have been preserved.

Weidenreich asserts that the pattern of the grinding surface of the Meganthropus molar is that typical of the Dryopithecus: this includes the sixth cusp which increases the impression of the simian nature of the Meganthropus. The grinding surface on the molar is wrinkled like that of an anthropoid. Judging by the shallowness of the canine socket the crown must have been a small one. This supposition is supported by the shape of the premolars that are reminiscent of human teeth. From this it may be assumed that the upper canines were also small. One canine has since been found.

On the basis of the height of the jaw at the chin foramen, it may be assumed that the dimensions of the body of the Meganthropus were surpassed only by those of the gorilla and Gigantopithecus and approximated those of orangutan. It is not only the peculiarities of the teeth that exclude the Meganthropus from the hominid family, but also the jaw itself. On the tongue side of the body of the jaw, for example, there is an enigmatic hollow for the digastric muscle 15 mm. deep in the vicinity of the symphysis. Weidenreich believes this hollow to be an anomaly. Nearby, as Weidenreich notes, there is a fossa for the digastric muscle, but its triangular shape and elongated flat surface differentiate it sharply from the corresponding fossa in man. We are of the opinion that both the hollow and the fossa are of natural origin and are due to some specialization of the muscles and bones in the region of the lower jaw. In any case such morphological deviations remove the Meganthropus from the list of man's ancestors.

The peculiarities of the contours of a vertical cross-section made through the medial plane of the reconstructed mandible of the Meganthropus also show how far removed it is from man. These contours show that the Meganthropus should be placed somewhere between the Dryopithecus and the Paranthropus. Lastly, we would draw attention to the mandibular foramen, which is situated low in apes and high in man. The opening is approximately on the level of the boundary between the premolars and molars at the height of the centre of the horizontal branch of the jaw body. In the Meganthropus it is placed at middle height in the body of the jaw, i.e., as in hominids. The mandibular canal, however, as can be seen from the cross-section, runs low down from the foramen, more like that of an ape, and not high up as in the hominid. Here again the Meganthropus is closer to the anthropoids.

We consider the pithecoid peculiarities mentioned above to be of greater importance than the hominoid which, it seems, are also found in the Meganthropus, and believe it more correct to place the Meganthropus amongst the anthropoids rather than the hominids. Owing to its unique elements of specialization and huge proportions the Meganthropus could not have been amongst man's ancestors and must be excluded from man's genealogy.

Gigantism amongst the Primates is the exception and not the rule: in India there was a giant Dryopithecus, in South-East Asia the Gigantopithecus and Meganthropus, and on the island of Madagascar the giant lemurs—Megaladapis and others—and the Proconsul major in East Africa. Far better known are the fossil anthropoids with pre-hominoid features and one cannot agree with Weidenreich that our ancestors were giants, something in the nature of an overgrown Adam and Eve. Weidenreich's hypothesis cannot provide the answer to the following question: how can the autogenetic conception of the development of the animal kingdom be reconciled with the reverse process of evolution that it proposes, i.e., the reduction in size or degeneration of the giant anthropoids and their conversion into men with bodies very much smaller than those of their ancestors? Weidenreich, in his scientifically unsound gigantoid hypothesis of anthropogenesis, has, if one may say so, perverted his own orthogenetic conception. Weidenreich's idea is also unsound because the geological antiquity of the Meganthropus and the Gigantopithecus is not so great as to place them amongst the ancestors of the hominids (Nesturkh, 1954).

We may conclude this analysis of some of the anti-Darwinist hypotheses of man's origin by suggesting that it would be convenient to divide the Upper Tertiary anthropoids into two groups. One of the groups would include the predecessors of the hominoids and of the apes morphologically related to them: these we could call the pre-hominoid anthropoids. In this group we would place the Dryopithecus darwini, Oreopithecus, Ramapithecus, Australopithecus, Paranthropus and Plesianthropus. The other Miocene and Pliocene anthropoids would be included in the group of pre-simoid anthropoids, the ancestors of the living gibbon, orangutan, chimpanzee and gorilla. There were more genera and species of Upper Tertiary anthropoids than there are of those living today and they were far more widespread.

A working hypothesis of this sort helps focus our attention on the pre-hominoid anthropoids and is of assistance in determining the immediate ancestor of man. It is more than likely that this ancestor was an Upper Pliocene relative of the Australopithecus living in South Asia where his fossil bones must be sought. This area, too, is the most probable habitat of the first men. Such a postulate is to a certain extent supported by the remains of fossil anthropoids found in India, China, Indo-China and Java, including the Gigantopithecus and Meganthropus. Early man began to spread from South Asia into contiguous regions:

before him lay new lands that he was able to make his own thanks to the solidarity of the primeval human herd, their communal activities and their tools.

Anti-Darwinist hypotheses of anthropogenesis have been and are being disproved by anthropological, primatological and general biological data. Darwin's theory of anthropogenesis has long served as a basis for work on the problem of man's origin. Engels used it as the foundation of his new, Marxist theory of anthropogenesis based on the method of dialectical and historical materialism.

The next part of our book is an attempt to throw a little more light on that turning-point in the history of the development of the animal kingdom at which man made his appearance.

Here it will be advisable to outline a few general concepts on the question of the division of man's genealogy and of the entire process of anthropogenesis into two unequal parts. The first division is extremely lengthy—from the first microscopic living beings to the immediate predecessors of the Pithecanthropi—it lasted almost 2,000 million years. The course of development taken by man's ancestors depended on the constantly changing reaction of the organism of one or another ancestor as a whole to changes in the environment, under the influence of purely natural, including biological, factors beginning with natural selection.

In the widest possible sense, even, one might say, in the philosophical sense, there was a constant quantitative accumulation of new qualities in the development of the animal kingdom, or, more precisely, in that line which led to the Pithecanthropi. All the time evolutionary change was going on that, in hominid ancestral forms, inevitably created a new quality that has neither before nor since appeared in any other subdivision of the class of mammals. This very special quality characterizes a new being—the earliest man. Owing to the work he performed in the sense that he regularly made his implements and used them in practice for the needs of life jointly with other members of the primeval horde, qualitatively new, social laws came into existence, new factors appeared that formed man's body and man as a whole.

P A R T T W O

PHYSICAL PECULIARITIES OF THE HUMAN BODY AND THE EMERGENCE OF MAN

C H A P T E R   O N E

THE ROLE OF WORK AND ERECT LOCOMOTION IN ANTHROPOGENESIS

1. THE ROLE OF WORK

Several times in the preceding chapters mention has been made of the fact that man, although the structure and other biological aspects of his organism are similar to those of the animals, possesses certain qualitatively different anatomical and physiological features that can only be explained by the specifics of evolution from ape to man under the influence of his activities.

The modern human organism displays a high degree of adaptation to the performance of work and to erect locomotion. But the latter is in itself also an adaptation to that most typical of all the arts of human life, the ability to work.

Data drawn from the natural and social sciences must be applied in an examination of the problem of man's inception and further development. Only a complex study of the problem can show how man evolved from the animal kingdom. The correct application of data provided by the biological and social sciences to the problem of anthropogenesis implies an all-embracing study of nature and society based on dialectical and historical materialism.

In his treatise on anthropogenesis, Darwin seems to have stopped half-way. He was able to give only a partial explanation of the way in which man's biological peculiarities took shape because he applied, in the main, purely biological laws.

According to Darwin's theory, the chief factors in the making of man were mutation, the struggle for existence, natural and sexual selection and the direct hereditary influence of the environment.

The founders of Marxism provided a synthetic solution of the problem of man's formation, giving first place to the influence of work. Engels' concept of the role of work in the evolution of man was not accepted by scholars of the idealist school of philosophy.

In the works of Marx we find cardinal concepts that take us deep down to the roots of anthropogenesis. In the first volume of *Capital* (Ch. 5, § 1) Marx defined the concept of "work" and indicated its tremendous role in dividing man off from the animal kingdom.

Marx regards operations with non-fabricated natural objects as the undeveloped, embryonic form of labour activity. Concerning man's use of implements, Marx says: "Thus nature becomes one of the organs of his activity, one that he annexes to his own bodily organs, adding stature to himself in spite of the Bible."* Tools, in a way, increase man's physical strength and enable him to overcome obstacles that would be beyond the power of his bare hands.

Work with fabricated implements is a more highly developed form of labour: "The use and fabrication of instruments of labour, although existing in the germ among certain species of animals, is specifically characteristic of the human labour-process, and Franklin therefore defines man as a tool-making animal."**

The work theory of anthropogenesis is a development of the basic postulates of Marxism.

Engels says that labour is the primary basic condition for all human existence, and this to such an extent that, in a sense, we have to say: labour created man himself.*** It is precisely work processes that constitute a distinct boundary between man and the higher animals such as the apes that he approximates in the structure of his body and common descent.

In his classic monograph on the role of work Engels begins at that stage of the development of our ancestors when they were, as he says, an unusually highly developed species of ape. This we understand as meaning a high level of corporeal organization in our ancestors, their flexibility in adapting themselves to a new environment and their well developed brain.

Erect locomotion, said Engels, was a decisive step on the road to humanizing the ape since this position of the body released the arms from their former functions in pronograde locomotion and as supports for the body. The hands at first became adapted to the very simplest forms of work and then developed progressively over the tremendously long period when man was taking shape under the influence of the labour he performed. Engels finds that work had a direct influence on the structure and functions of the hand and that individually acquired peculiarities were transmitted by heredity.

He stresses, however, that orthograde locomotion was not something that our ancestors achieved all at once; it first became a general rule and later a matter of necessity. The erect posture acquired a new signif-

* K. Marx, *Capital*, Vol. I, Chap. VII, Section 1, Moscow 1954, p. 179.
** *Ibid.*, p. 179.
*** F. Engels, *Dialectics of Nature*, Moscow 1954, p. 228.

icance and was able to progress because the hands had been given an absolutely new function, i.e., the use of implements. This latter feature ceased to be an accidental manifestation and became a vital necessity, a specifically typical action that evolved into the collective fabrication of implements and their use by a community of similar beings. This, again, led to the evolution of the hands in a definite direction: the hand became not only the organ of work but was also its product, its structure and functions reflecting man's labour activities as part of the whole. The changing hand affected the whole human organism and, as it was correlatively connected with the body, it experienced the influence of the latter.

Speech, in the form of diffused sounds, arose in the course of social work and from it articulate speech developed as a new, extremely necessary and useful form of communication. Language, therefore, is a product of social development. It could only have arisen amongst the possessors of a well-developed brain in which a certain level of development had been reached in the speech regions in the cortex of the frontal and parietal lobes.

Work and speech, in turn, had a powerful influence on the progressive development of the brain and the senses.

The advancement of all these human qualities was greatly stimulated by an important new factor—the community. In his article on the role of work, Engels shows clearly the significance and the limits of the influence brought to bear by basic natural and social factors on the formation of man and gives pride of place to socially performed work. Man is sharply delineated from the animals as a social being who manufactures implements and uses them in his collective labour.

Work with the aid of artificial tools was developed in and by the community. And the emergence of the human community itself can only be conceived if we imagine man's immediate ancestors as gregarious animals. The founders of Marxism believed that man had, from the earliest times, shown an inclination to live amongst others of his own kind, the social instinct being one of the most important factors enabling the ape to become a man. Once the ape had become a man, however, his social life differed from the herd life of his anthropoid ancestors.

At first man differed little from an animal. Work began in the earliest stages of his development.

The production of material values, the emergence of production relations and social development all served to separate man more and more from the animal world and enabled him to develop in a way that differs from the evolution of the animals: men began to influence their own development and this influence became greater as time went on (Engels, *Dialectics of Nature*).

The emergence of man, moreover, meant a break-away from the animal kingdom insofar as human society constituted a qualitatively

new phenomenon: to a certain extent human society stands in opposition to the environment in which it develops.

The ape herd and the human community developed along different lines and differ greatly from each other. Engels said: "The most that the animal can achieve is to *collect*; man *produces*, he prepares the means of life, in the widest sense of the words, which without him nature would not have produced. This makes impossible any unqualified transferrence of the laws of life in animal societies to human society."*

Marx and Engels had a high opinion of Darwin's work on evolution in the animal and vegetable kingdoms, but they also criticized his unjustifiable mixing of biological and social categories.

The more detailed Marxist analysis of the problem of anthropogenesis carried out by Engels shows us man as a new, qualitatively different, social being. Nevertheless, man is still a part of nature and in him nature, as it were, asserts herself. In Engels' words, man belongs to nature, flesh and blood and brain, and remains part of nature, but he differs from the animals in his recognition of nature's laws and his ability to apply them correctly.

Engels especially stresses the qualitatively specific nature of the process of anthropogenesis: man adapts himself actively to his surroundings and later gains mastery over nature. Man could only have achieved his power through conscious and constant labour activity. Work created an impassable abyss between man and the animals, and their lines of development not only became greatly different but branched off in absolutely opposite directions.

2. METHODS OF LOCOMOTION OF THE GREAT APES

The development of biped locomotion was a preliminary condition for the liberation of the fore limbs of our immediate ancestors, the anthropoid apes.

At first movements on two legs were weakly developed in our ancestors and they probably showed diffidence in moving on the ground for a lengthy period. The poorly developed erect position gained strength in the process of natural selection: it became an absolute necessity under conditions of life in the open. Erect locomotion had become the general rule by the Australopithecus stage and labour activities became possible. In anthropogenesis, therefore, the erect position is an important biological prerequisite.

The primitive development of erect locomotion and the emergence of work activities brought forth a further specialization of the human organism that provided features of adaptation to various forms of work, while the simian features weakened and many of them disappeared.

* F. Engels, *Dialectics of Nature*, Moscow 1954, pp. 404-405.

The transition to erect locomotion in our ancestors took place over a great span of time in the second half of the Tertiary Period: biped locomotion probably developed in the course of millions of years. By the beginning of the Quaternary Period erect locomotion was no doubt so well developed that the fore limbs no longer took part in supporting the body or in movement on the ground. Finally, an ape of the Australopithecus type could develop into a Pithecanthropus with his erect gait.

We must agree with Engels and Darwin in regarding erect locomotion as the chief factor in reforming the human body in a certain direction. The greater part of the features that are typical of man's anatomical structure are directly or indirectly connected with the development of biped locomotion. Among them are: a foot supporting the body that is provided with a longitudinal arch and a well-developed, strong and long great toe; a hand with a very highly developed thumb and a strong sense of feeling, especially in the tips of the fingers (fig. 45); the form of the vertebral column with its series of four curvatures of which the lumbar is the most typical; the position of the pelvis at an angle of 60° to the horizontal; a skull that has room for a big and heavy brain but which is well poised on the vertebral column; the almost horizontal plane of the foramen magnum which is closer to the anterior part of the skull and points straight downwards or even slightly forward (in the great apes it points slightly backward); the big cranial and small facial part of the skull; weakly developed external relief of the skull; a very big brain of complicated structure; characteristic proportions of the body (longer legs and shorter arms in relation to the length of the trunk). Especially progressive organs that continue to improve (in their manifestations) are the brain, hands and speech organs.

Man differs from the other Primates in a number of features that are not connected with erect locomotion, among them such structural peculiarities as, for example, the anterior prominence on the chin (mental protuberance), weakly developed canines that are no longer than the other teeth, lips developed in their central or transitional parts and a furrow between the upper lip and the nose.

In order to explain how our ancestors changed their arboreal way of life for the terrestrial and how biped locomotion developed, we must examine the modern apes' methods of locomotion in the trees and on the ground. During life in the trees all four limbs of the monkey serve primarily as prehensile organs.

Outwardly the monkey's foot so closely resembles its hands that at first glance it seems to be quadrumanous, as it was once erroneously termed. The monkey can grasp the limb of a tree with equal agility with either hands or feet and, indeed, functionally the feet do resemble hands. An anatomical comparison of the structure of a monkey's hands and feet with those of man that shows the number and structural character of the bones, muscles, blood vessels and nerves is sufficient to convince us that the hind limbs of the monkey correspond to the

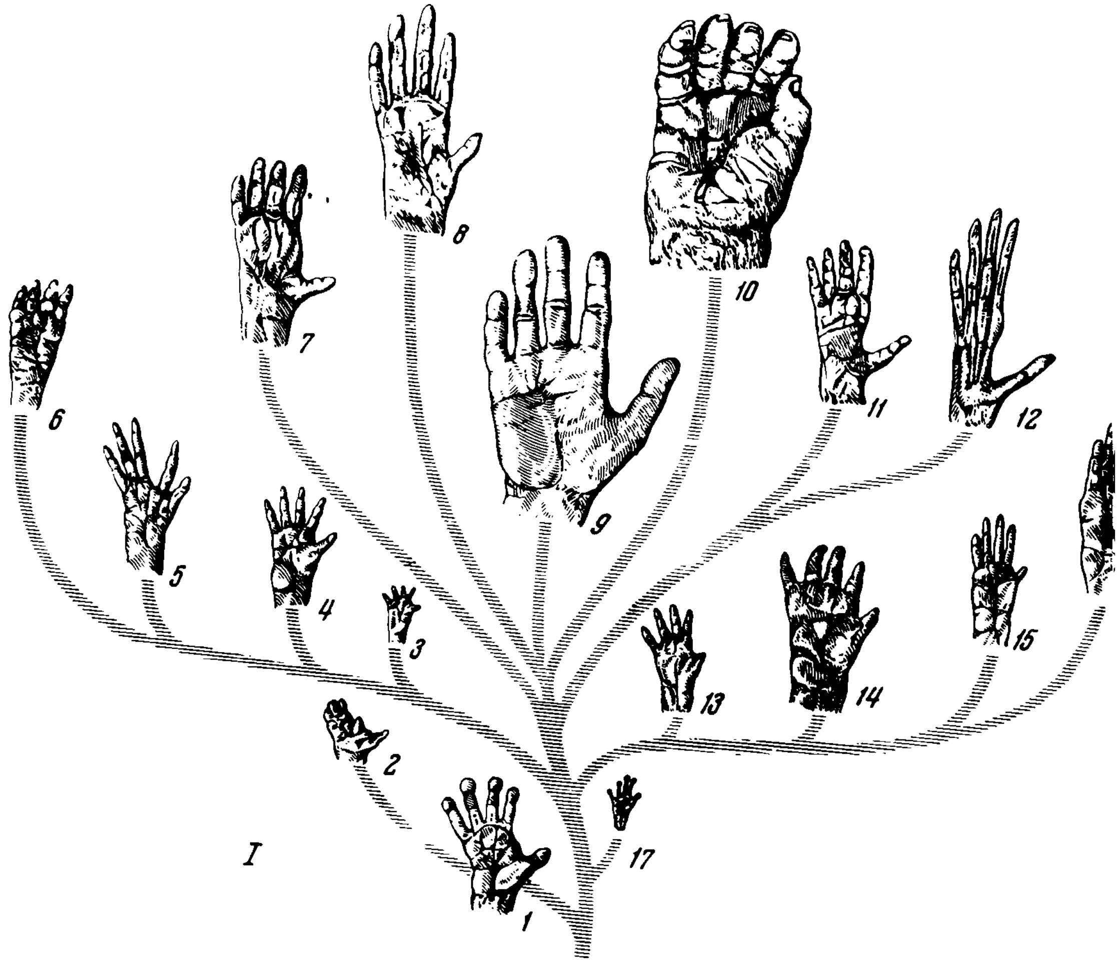


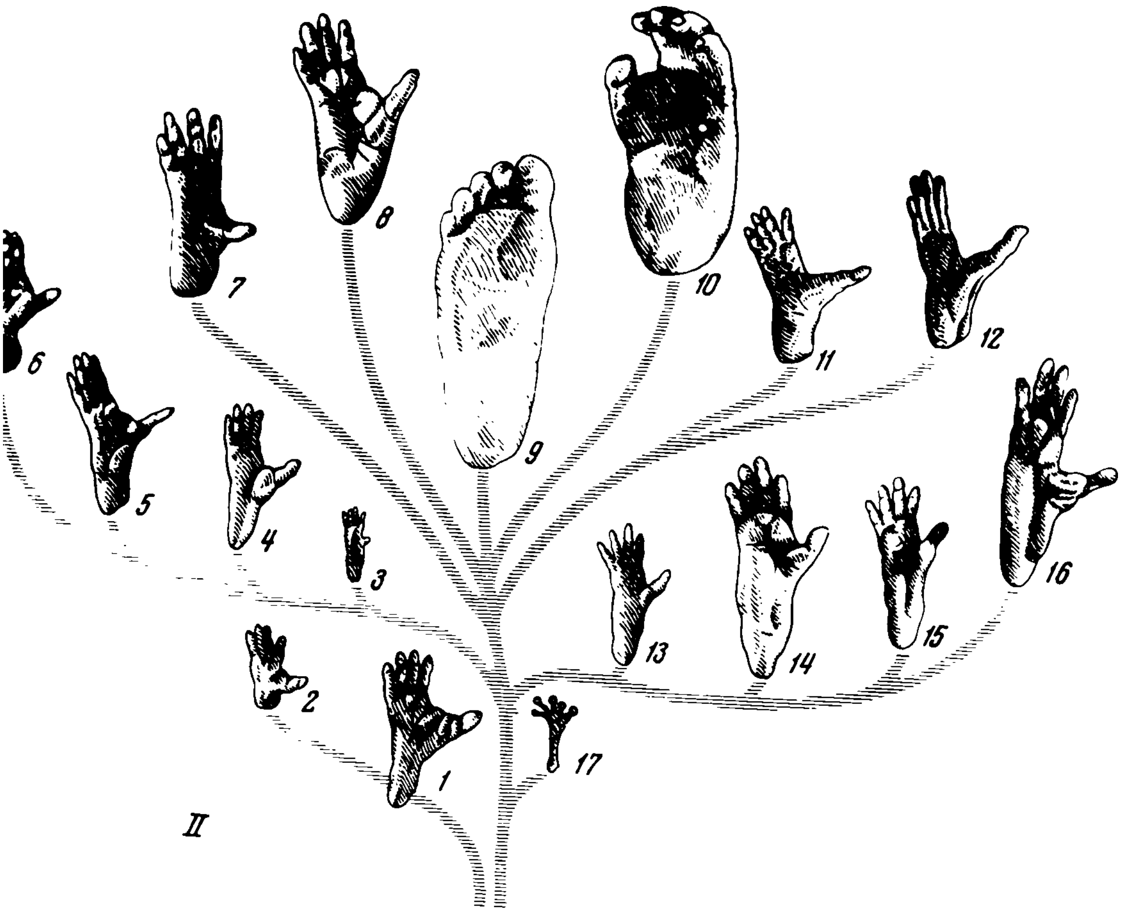
Fig. 45. Shape of distal

I—hands and *II*—feet of man,

1—Lemur variegatus Kerr; *2*—Perodicticus potto P. L. S. Müller; *3*—Hapale jacchus L.; *4*—Cebus versutus schweinfurthii Giglioli; *9*—man—Homo sapiens L.; *10*—Gorilla gorilla beringei Matschie; *11*—Symphalangus L.; *15*—Lasiopyga callithrichus Oken; *16*—Colobus After W. Gregory and

inferior extremities (the legs) of man. The fore limbs, in the same way, correspond to man's superior extremities (the arms).

In climbing trees the monkey uses all four limbs. It moves along branches with perfect confidence, its tail helping it keep its balance. Some of the higher apes (gorilla, chimpanzee, orangutan) may walk on their hind limbs alone for a few steps and the gibbons, as a rule, walk on their hind legs and use their long fore limbs to balance themselves. There are also lower monkeys that walk on their hind limbs on the ground, for example, the American spider monkeys who balance themselves with their long tails held up in the shape of a mark of interrogation.



regions of primate extremities:

monkeys and half-monkeys.

D. G. Elliot; 5—Alouatta seniculus L.; 6—Ateles ater F. Cuvier; 7—Pongo pygmaeus L.; 8—Pan syndactylus Gray; 12—Hylobates leuciscus E. Geoffroy; 13—Macacus sinicus Blyth; 14—Papio Hamadryas abyssinicus Pallas; 17—Tarsius spectrum Pallas.
M. Roigneaux, 1937.

When a quadruped changes over from an arboreal to a terrestrial way of life there must inevitably be changes in the method of locomotion in one of two directions. The first possibility is the development of various methods of locomotion on four legs when on level ground (fig. 46). This path of development was taken by the gorillas, baboons and red monkeys (Erythrocebus patas Schreber). The second possibility is an entirely new departure for an ape—ground locomotion on two legs. The latter line of development was taken by man's ancestors and their nearest relatives. The possibility of a change-over to erect locomotion may be judged by the living apes.

The method of locomotion used by the anthropoid apes, especially

Fig. 46. Baboon and gorilla (position of the skeletal support of the trunk during different types of locomotion). After E. Loth, 1932.

by the gibbons (fig. 47), differs greatly from the quadruped locomotion of the lower monkeys.

The fore limbs of the gibbons are extremely long and strong, while the hind limbs are short and are weaker both relatively and absolutely. It would be very awkward for the gibbons to walk on all fours and they resort to this method of locomotion very rarely. The biped locomotion of the gibbons, therefore, is of different origin from that of man who has long, strong legs and short, weak arms. The gibbons, furthermore, rarely move on the ground and when they do, they are rather awkward in their movements, although they run along on two legs at a fairly high speed. The example of the gibbon walking on the ground in a more or less erect position (with the body bent, it is true), is of interest to us because his body can apparently remain on two legs for a long time without any special effort.

The peculiarity was acquired by the gibbon, in particular, as a result of his movement through the trees by hanging from the branches which he grasps with his hands alone. Holding his trunk in a vertical position he swings from one branch to another with the help only of his fore limbs. He tucks up his hind limbs like a flying bird in order to reduce the resistance of the air.

When swinging from branch to branch, that is, during brachiation, the gibbon resembles a two-armed animal rather than a quadruman or quadruped. The gibbon's method of locomotion on the ground is different: the bimanual anthropoid gibbon then becomes bipedal. One has only to imagine that the great arboreal anthropoid apes, who did not possess the long fore limbs of the gibbon, were compelled to take to the ground in search of food or for some other reason, to believe it

possible and even essential for them to make considerable changes in their method of locomotion under conditions obtaining in open country. Man himself, apparently, owes his emergence to a considerable extent to the transition from life in the trees to life on the ground.

It must be assumed that the common ancestor of man and the great apes was not so highly specialized as the living anthropoids and that the thumbs of the extinct species were not so greatly reduced as those of the chimpanzee or orangutan.

We may suppose that the anthropoid apes that served as man's ancestors made partial changes in their method of locomotion while they were still living in the trees. It is probable that they, like the living gorilla and chimpanzee, did not so much grasp the branches with their feet when moving through the trees as walk along thick branches, balancing themselves by grasping higher branches with their hands.

Fig. 47. Gibbon during brachiation. Young Hylobates lar, Baby, at the Moscow Zoological Gardens, 1935.

Photo from Moscow Museum of Anthropology.

This idea was put forward by the eminent anthropologist Sir Arthur Keith (1934). He was of the opinion that man's ancestors, during the last period of their life in the trees, used their lower limbs for movement more than their upper limbs; he even calls our ancestors cruriating animals as opposed to the ancestors of the living anthropoids, who were brachiating animals. Our ancestors, the cruriators, held their bodies in a more or less vertical and straightened posture. This was a circumstance that enabled them later to move on the ground on two legs. Further locomotion was accomplished in a more and more erect position. The long process of the development of orthograde locomotion reached greatest perfection only in modern man. But obvious traces of man's descent from an ape-like ancestor who lived in the trees at a very distant period have been retained

in his body to the present day. Man's hand retains some of the peculiarities of the structure of the once highly developed prehensile limbs of his arboreal ancestor. Man's hand, however, has undergone considerable change in the course of its use for work by numerous generations for hundreds of thousands of years.

We see from the example of the living anthropoids that they have a very uncertain gait when moving on their hind limbs alone. The gibbon performs these best of all, but he balances himself with his arms, holding them out level with the shoulders or even placing them on his head. The chief support is the foot which, like the chimpanzee's, has three points of contact with the ground: 1) the heel, 2) the great toe which, in these anthropoids, is highly developed and projects outwards and 3) the remaining four toes held together.

These peculiarities in the structure of the foot, especially the highly developed great toe, enable the gibbon and the chimpanzee to remain poised on two legs better than the orangutan or gorilla.

In man's foot, it will be remembered, the main point of contact is the great toe which has not only developed progressively in the course of evolution, but has become closely bound to the second digit. The gorilla's great toe is not so evolved. This ape has a heavy body and when standing or walking on two legs is very unstable and rarely, therefore, resorts to that position. The typical pose of the gorilla and chimpanzee is semi-erect, practically on all fours, the digits of the hands are bent and the ape usually rests his weight on their medial or terminal phalanges.

The big toe of the orangutan, on account of his purely arboreal way of life, is nothing more than a short, thin outgrowth from the foot on which there is usually no toe-nail. The orangutan's other toes are very long and function in unison, like a hook. As they are always bent to some extent it is almost impossible to unbend them into one plane with the sole of the foot; it is easier to do this with young animals. On those rare occasions when he stands or walks on two legs he usually rests his weight on the outer edges of the foot with the toes turned inwards and all of them, from the second to the fifth, in a horizontal position but more or less curled up in rings.

The young male orangutan Moritz, in the Moscow Zoological Gardens, walked on two legs, resting his weight on the entire sole of the foot and on the bent toes; it is possible, however, that he adapted himself to this method of locomotion during his life in captivity. Another orangutan in the Moscow Zoological Gardens, a female named Frina, during the first years of her life sometimes walked on the ball of the foot and on the upturned surface of the toes, but later, at an age between 5 and 10 years she began to walk on the outer edge of the soles and on her horizontally curled toes. The young female chimpanzee Mimosa walked with some of her weight supported by the outer edge of the foot, but mostly putting her weight on the triangle: sole, great toe, and the other toes constricted.

An orangutan's gait resembles that of a man on crutches as his legs are short and his movements are made by jerking them forward between the widely outspread arms that give him support on the ground. The apes have very different gaits: standing on two legs they may hop, mark time, "dance" or twist round in one place. Varying degrees of transition from quadruped to biped locomotion are found among them; in all cases the erect stance is easier for them than for the quadruped monkeys.

The living anthropoid apes are extremely interesting animals: by studying their methods of arboreal and terrestrial locomotion we can to some extent get a picture of that period of transition when our ancestors began to change their quadruped gait for erect locomotion. The evolution of the ancestors of the living anthropoids differed from that of man's ancestors because they lived in another environment; they continued to live in forested areas and perfected methods of locomotion in the trees. Their pectoral limbs became longer, especially those of the gibbons and orangutan, but to a lesser degree in the chimpanzee and gorilla whose ancestors came down to the ground at a later date. The pelvic limbs of the great apes, on the contrary, grew shorter both relatively and absolutely.

At the time when the ancestors of the chimpanzee became partially and the ancestors of the gorilla almost entirely terrestrial animals, they had become more specialized and were almost incapable of effecting the transition to the erect position that was typical of man's ancestors. But the slow progression of the living anthropoids in the trees, during which they do not so much climb as walk on the limbs of the trees holding on to higher limbs with their hands, is reminiscent of the type of arboreal locomotion that was common to an early stage in the development of the common ancestors of man and the great apes (Gremyatsky, 1955).

The development of biped locomotion was connected to a greater or lesser extent with the liberation of the fore limbs from their functions as supports and aids to locomotion. As our ancestors adapted themselves to life in open country and to the use of natural objects as implements or weapons their erect gait was perfected.

In the early period of the transition to movement in the erect position the adoption of a more or less vertical position by the body must have developed very rapidly in the process of natural selection under the influence of a fiercer struggle for existence in the new conditions, especially the interspecies struggle against various terrestrial beasts of prey.

Theoretically, the further development of terrestrial locomotion could have led our ancestors either back to the semi-erect position of the body with the curled fingers of the hands serving as ground supports when moving which would have closed to them the road to humanization; or there could have been a very great perfection of locomotion in the erect position which would open the road to humanization and further progress.

Our ancestors evolved in the latter way. At some stage of evolution they most probably crossed the critical boundary at an accelerated rate

after which the progress of evolution in the erect position proceeded more regularly but was still fairly intensive. Other, less developed species of fossil apes that had practised erect locomotion but in different natural surroundings, apparently never crossed the critical boundary: some of them became extinct and others became the ancestors, for example, of the chimpanzee with its semi-terrestrial or the gorilla with its fully terrestrial mode of life.

3. THE WEIGHT OF THE BODY AND THE CENTRE OF GRAVITY IN MAN AND THE APES

Our ancestors' transition to erect locomotion was probably complicated by the fact that they belonged to the bigger and heavier types of anthropoid apes. Modern man is among the heaviest of the Primates, the average weight being between 60 and 75 kg. Males often reach a weight of 90 to 100 kg. and more (350-400 kg. and more in extreme cases). The gorilla is, on the average, much heavier than man, the males having a weight of 100-150 kg. with some of them much bigger (up to 200-300 kg.). The young mountain gorilla Bobby (figs. 48a and 48b), living in Berlin Zoological Gardens, weighed 262.5 kg. at the age of $10^1/_2$ years. The gibbons cannot compare with man as they weigh from 5 to 18 kg.,

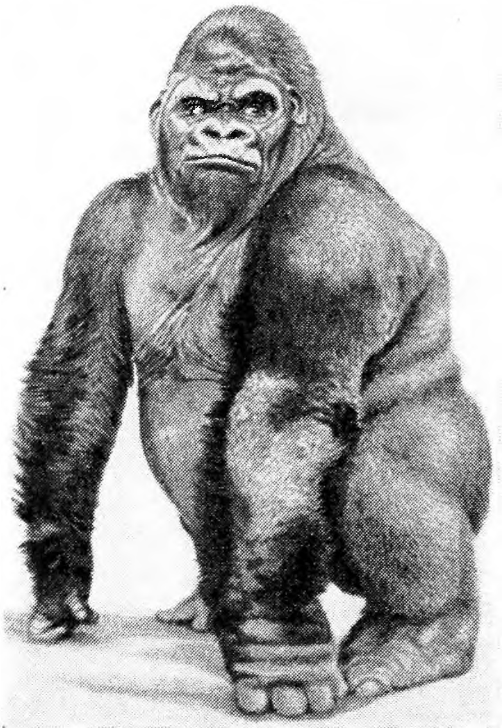


Fig. 48a. Young male mountain gorilla (Gorilla gorilla beringei Matschie). Bobby, aged 10 years. Berlin Zoological Gardens.
After S. Eipper, 1933.

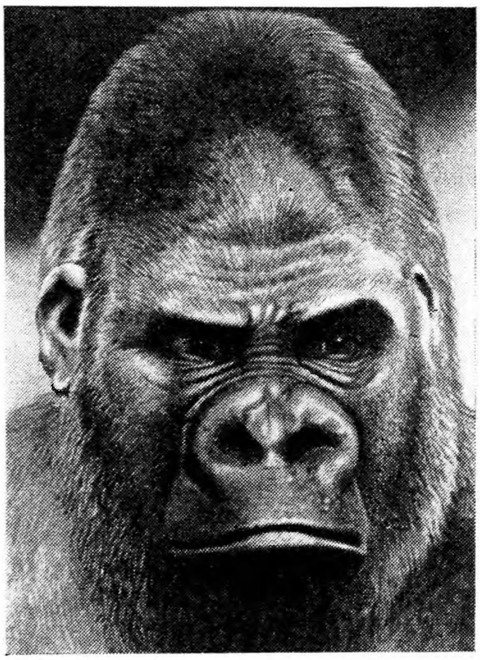


Fig. 48b. Young male mountain gorilla, Bobby, aged 10 years.
After S. Eipper, 1933.

i.e., the weight of a human child between six and twelve months old. The female of the gibbon differs very little in weight from the male.

The difference in the weight of the two sexes is very small both in the gibbons and the chimpanzee when compared with the gorilla and orangutan whose females have a weight of from three-fifths to two-thirds of the males. According to Lyon (1911) four male orangutans from Borneo weighed 175, 180, 200 and 260 kg. and four females 72, 82, 88 and 100 kg. respectively.

In human beings the difference in weight between the two sexes averages 5 to 10 kg. European women, for example, have an average weight of 56 kg. (with individual variations mostly between 38 and 76 kg.) and the average weight of men is 64 kg. (with individual variations between 42 and 84 kg.).

The weight of the human body has a different significance from that of the pronograde mammals as it rests on only two limbs and not on four. The relative load on man's legs, therefore, is double that of the quadrupeds. When the great apes stand on two legs it is obvious how difficult it is for them to stand or walk in that position. They are typically unadapted to lengthy locomotion on two legs over an even surface. The centre of gravity in such a pose is much higher and farther forward in the apes than in man; this is due, especially in the orangutan and the gorilla, to the powerful trunk, muscular arms, big head with its massive jaws, and the huge stomach covered with a thick layer of fatty tissue.

If a plumb-line be dropped from the ape's centre of gravity it will fall in front of the space occupied by the feet which shows that the animal is unbalanced. The muscles of the legs and trunk are not able to support the body in the erect position and the ape rests its hands on the ground and adopts its typical semi-quadruped pose. The situation is different in the trees where the ape can grasp higher branches with its hands and remain in the upright position for a long time.

Man differs from the apes, first and foremost, by being accustomed to erect locomotion on an even surface. The human organism is adapted to stand for long periods and to walk and run on two legs. Man is no longer adept in walking on all fours.

Georges Cuvier (1798) wrote that man could not walk on all fours because his eyes would be looking downwards; his neck muscles are not strong enough for him to hold his head in the proper position; his lower limbs would be raised too high relative to his arms, and his feet are too short for him to use them as animals do, using the toes for support; his chest, being too wide, would hamper the free movement of his arms. Nor can he climb as easily as a monkey, because his great toe is not separated from the other toes, or as easily as a cat, because his nails are too weak.

Man's foot rests on a comparatively small area. His centre of gravity is rather high, usually at the height of the second or third sacral vertebra. With the body in the erect position a plumb-line dropped from the centre

of gravity falls through a point some 5 cm. behind the line joining both coxofemoral articulations and then another 3 cm. in front of the medial malleoli and rests on the ground within the area occupied by the feet (V. P. Vorobyov, 1932, M. F. Ivanitsky, 1956).

Man in the erect position is incomparably more stable than the great apes. A young child, however, at first stands and walks very uncertainly owing to poorly developed muscles and lack of co-ordination in its movements and to its instability which accounts for the frequent falls of young children. The very process of transition from the crawling to the walking stage of development shows how long and how difficult it is.

The pelvis of the child learning to walk is not yet in the position necessary for developed erect locomotion: it is almost in line with the vertebral column and later diverges from this position with the lower part forward; the angle of 50°-60° from the horizontal (30°-40° from the vertebral column) is typical for the more adult. The disproportionately large and comparatively heavy head of the infant increases its instability; the neck muscles are still comparatively weak and the centre of gravity is higher than that of the adult which again worsens the balance of the child.

The infant's transition from the crawling stage to erect walking reminds us of an important moment in the evolution of our ancestors when erect locomotion first began to develop. The child on all fours is reminiscent of the more distant of man's ancestors, the quadruped vertebrates. Aleš Hrdlička (1932) carried out a special investigation of the peculiarities of crawling with several hundred children. He considers that such a method of locomotion typical of young infants is a manifestation of instinct inherited from pre-human ancestors and that it was developed by much earlier forms of mammals or even the reptiles of the Mesozoic Era.

After our ancestors had achieved a certain degree of erect locomotion and with the aid of the liberated hands had turned to the use of natural objects as implements and weapons, the development of this new type of activity would have been impossible without a further perfection of the biped habit. A heavy club or stone in their hands would help increase their instability on feet that were still too flat and with spines that were still not curved sufficiently. Individuals that stood most firmly on their feet and were the better masters of their implements would prove better adapted for the struggle for existence; these individuals must have handed down from generation to generation a more stable organization of the body.

4. THE INFERIOR EXTREMITIES

In the course of anthropogenesis the hind limbs of the ape were transformed into the legs of man. The changes were mainly in the character and degree of development of the muscles and in the structure of the straightened knee joint. The structure of the foot also changed; the

longitudinal arch appeared; in standing and walking the main support changed from the outer to the inner edge of the foot and the great toe increased in size and grew closer to the others.

A flexible longitudinal arch is the most specific feature of man's foot. It developed in the hominids by means of a reorganization of the foot skeleton accompanied by changes in the muscles and ligaments. The sural, quadriheaded and gluteal muscles developed progressively and became the muscular features most specific in man. It was these changes in the former hind limbs that converted them into man's powerful legs that were capable of supporting the bodies of our progressively more erect ancestors when standing, walking and running.

William Gregory (1934) is of the opinion that a foot similar in structure to that of the chimpanzee or gorilla (fig. 49) could, over a sufficiently long

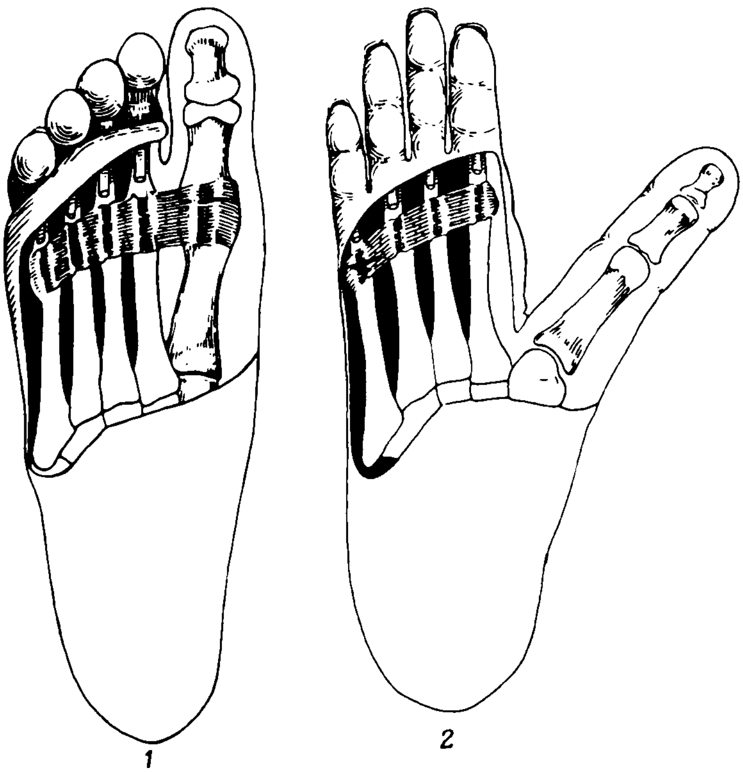


Fig. 49. Feet of higher Primates:
1—man; *2*—chimpanzee. Transverse metatarsal ligament joins five toes in man and four in chimpanzee. After F. Jones, 1929.

period, develop into a human foot under the influence of erect locomotion. Other scholars, G. Miller (1925) and V. V. Bunak (1954), for example, object to this admission: they maintain that during the period of pre-natal development the great toe of the human foetus, according to Leboucq's investigations, shows no signs of opposition to the other toes and that man's foot must be derived from a structure different from that of the apes.

The structure of the human foot is one of the most important and at the same time one of the most difficult features in the explanation of how man became a biped. The liberation of the hands for the use of implements was most intimately dependent on this important biological condition—the development of a flexible walking foot—which, in turn, took place simultaneously with the conversion of the former prehensile limbs of our ancestors into the lower fulcral limbs of the early hominids.

The change to biped habits was not only facilitated by the preliminary conditions having arisen through the more erect posture of man's ancestors (cruriation) during the arboreal period of their life; it was brought about mainly by the fierce struggle for existence under new natural conditions of environment.

In the savannahs and, later, in the open plains ancestral man had to escape carnivorous enemies by vigilance, flight and concealment. He had to raise himself on to his lower limbs to get a view of a more extensive area. In times of danger early men could conceal themselves from their enemies in good time, in a grove of trees, for example, could climb trees or could join forces and use their weapons to drive wild beasts away.

It is obvious that under these conditions those herds of our ancestors would survive that were best adapted to life on the ground under the conditions of more or less open territory.

This must have been the case at the time when our ancestors changed the arboreal for a terrestrial way of life; they remained instinctively in the vicinity of small woods, groves and groups of trees. The erect position was, probably, also developed by the search for food in the form of fruits on low-growing trees and bushes and also in hunting animals with the aid of sticks and stones.

The very considerable weight of our ancestors must also have been of great significance in the transition to erect motion. If we assume that they had, at that period of evolution, a weight of between 40 and 60 kg., each of their upper extremities was released from a weight of 10-15 kg., while each of the lower extremities received a double load that amounted to 20-30 kg. Such a redistribution of weight, naturally, must not only have led to, but must itself have caused, profound changes in physical structure. In the anatomical peculiarities thus engendered the lower extremities underwent a much greater reconstruction than the upper.

The foot of modern man is shaped very differently from the prehensile foot of the apes whose great toes are readily opposable to the others. The great toe of the human foot is no longer opposable to the others and lies more or less parallel to them. It is joined to them by a strong transverse ligament (ligamentum metatarsale transversum) thus differing very greatly from the foot of the chimpanzee (fig. 49) in which the transverse ligament connects only four toes (the second to the fifth). Researches carried out by Henry Raven (1936), however, show that the elastic fascia between the chimpanzee's first and second toes is a homologue

of the corresponding division of the transverse ligament in man; the fascia is thick and strong.

Another convincing proof of the development of man's foot from that of the ape is the presence of the oblique head of the abductor muscle of the great toe (which is very characteristic of the Primates as distinct from the other mammals). This part of the muscle is less developed in man than in the apes (fig. 50), varies very greatly in individuals, is to some extent rudimentary and may even be entirely absent.

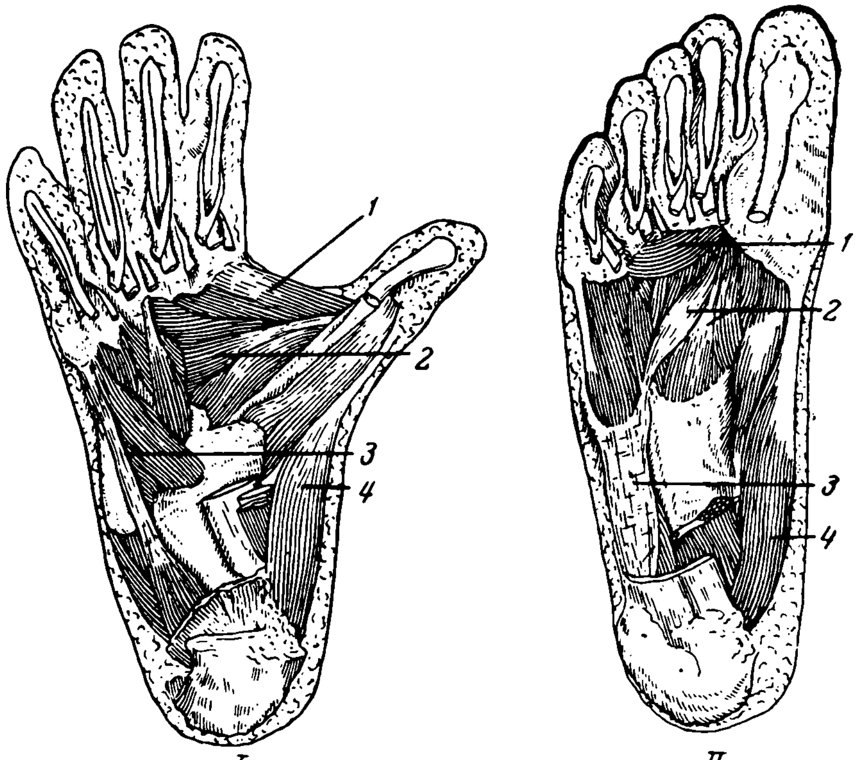


Fig. 50. Muscles of plantar surface of foot of (*I*) gorilla and (*II*) man: *1* and *2*—transverse and oblique heads of abductor muscles of great toe; *3* and *4*—adductor muscles of little toe and great toe. After H. Raven (W. Gregory and M. Roigneaux, 1937).

As a result of the somewhat flattened articular facet of the first metatarsal with the medial cuneiform bone, man's great toe can only move very slightly laterally from the others and cannot oppose them like that of the ape which has a saddle joint at this point.

Man's thumb, on the contrary, is readily opposable to the other digits. The human hand is, in general, similar in structure to that of the ape. But man's ability to do work and his use of various implements for the execution of that work have brought about a number of noticeable changes in the hand.

When man's upper extremities had been relieved of the functions of locomotion and support to a greater degree as compared with those

of the ape, they were able to make a number of rotational movements owing to changes in the muscles, tendons and bones of the pectoral girdle, in the freed upper extremities themselves and in the hands. But the lower extremities, on the contrary, had the whole weight of the body transferred to them and had some of their former functions reduced. They could, for example, no longer be used for grasping and scratching, the sural and gluteal muscles became much stronger and the femur and tibia became more massive.

There is also a difference between man and the ape in the vascular system of the lower extremities. Man has no saphenous artery such as the apes have but, like them, he has a saphenous vein, the biggest in his leg. The complete absence of the big saphenous artery in man is connected with his erect posture (it is very rarely found in man as an atavism).

As the erect position of the body became a permanent feature the lower extremities lost some of their functions and acquired others: their main function now is to support the body when standing or in motion and also during locomotion. The ability to hold the body erect and maintain its stability for a long time was one that evolved over a period of hundreds of thousands of years. In relatively recent times the Neanderthalers, judging by the bones of their feet and other parts of the skeleton, moved very clumsily; their bodies were not fully erect, the curves of the spine were underdeveloped and were almost like those of the anthropoids. Their legs, however, were probably bent at the knee joints.

It is not only the musculature of man's foot that shows signs of its development from that of the ape. Many people have a second toe that is longer than the great toe, so that the length formula of their toes is $2 > 1 > 3 > 4 > 5$. Usually, however, the great toe is the longest and the typical formula for the human foot is $1 > 2 > 3 > 4 > 5$ while that of the apes is $3 > 4 > 2 > 5 > 1$.

A longer second toe is frequently met with on statues of the period of antiquity which gives rise to the name "Greek foot." An examination of the skeletons of people who lived several thousand years ago shows that this type of foot was probably much more widespread than it is today. It is safe to assume, however, that the foot with the long second toe is more like an ancient form, closer to that of man's simian precursor. At one time the longest toe on the foot of man's distant ancestors was the middle one. Very rarely the formula $3 > 2 > 1 > 4 > 5$ is met with today. In human embryos four weeks old the third ray of the foot is longer than the others. Schultz (1929), studying three-month-old human foetuses, found that the third toe is longest in only 4.4 per cent of cases examined.

As the hominid foot developed the great toe became bigger and stronger and the development of the others was checked. The little toe, in particular, shortened: its nail is usually deformed and the two distal phalanges are often joined, which, incidentally, may also occur in the fourth toe.

The shape, structure and strength of the foot give modern man sufficient stability for the most varied movements (S. I. Shchelkunov, 1940). Man displays the most amazing ability to maintain his balance when climbing, performing acrobatics, ballet dancing, or in gymnastics and sports of the highest class.

That same modern man, however, possesses obvious signs of insufficient adaptability to lengthy stance or walking on two legs, while the carrying of loads may lead, for example, to flatfoot or varicose veins.

Rickety curvature of the legs in young infants whose living conditions are unfavourable is not only due to a deficit of calcium, but also to the fact that the infant's two legs have to carry the weight that is supported by four legs in the apes and other mammals.

When the baby begins walking on two legs very considerable morphological and physiological changes take place in his feet. I. A. Semyonova (1937) studied structural changes that take place from the time the embryo is ten weeks old and during the first two post-natal years; she found that the greatest change takes place when the child is learning to walk. It is difficult for man to stand still or walk for lengthy periods, his muscles tire and he is forced to sit down to rest, while a heavy quadruped, such as a horse, can remain on its feet for twenty-four hours or more without injury.

Not only the structure of the foot but also its length shows its similarity with those of certain apes and monkeys (the following data are taken from Rudolf Martin's book, 1928, Vol. 1).

THE LENGTH OF THE FOOT AS A PERCENTAGE OF THE LENGTH OF THE TRUNK (LIMITS OF VARIATIONS AND SOME AVERAGES)

Inhabitants of Baden			
Men	52.0 (46-60)	Marmoset	47.0-41.6
Women	49.8 (41-66)	Rhesus monkey	52.0-47.5
Orangutan	71.6 (62-87)	Baboon	53.3-48.4
Gorilla	58.5 (58-59)	American monkeys	45.2-45
Chimpanzee	57.5 (52-62)	Spider monkey	69.0
Gibbon	54.2 (49-65)	Lemurs	43.0-34.5

From these data it is clear that man approximates the group of anthropoid apes among which the orangutan, with its unusually long foot, is an exception, as is also the prehensile tailed American spider monkey. This peculiarity indicates a high degree of specialization in the orangutan —its adaptation to slow climbing, hanging by its arms from the branches and grasping them with its feet. The spider monkey, who hangs from trees by its feet and tail, transfers a considerable part of the weight of its body to its hind limbs.

Man, however, is an exception among Primates as far as the length of his leg from hip to ankle is concerned (R. Martin, *idem*).

LENGTH OF THE LEG FROM HIP TO ANKLE AS A PERCENTAGE OF THE LENGTH OF THE TRUNK IN MAN AND OTHER PRIMATES

Inhabitants of Baden		Mangabey	105.7 (104-108)
Men	158.5 (136-185)	Marmoset	99.7-93.2
Women	159.1 (135-197)	Rhesus monkey	110.2-96.2
Gibbon	130.7 (113-149)	Baboon	119.0-111.0
Chimpanzee	113.0 (104-120)	American monkeys	94.5-91.4
Gorilla	113.0 (111-115)	Spider monkey	139
Orangutan	112.7 (105-131)	Lemurs	110.0-85.0

Typical of man's femur or thigh-bone is the rough line (linea aspera) on its posterior side which serves to anchor several strongly developed muscles and also the very considerable length of the neck. The angle formed by the neck of the femur and the diaphysis is greater than that of anthropoids because the tip of man's great trochanter is lower and that of the ape's higher than the head of the femur. Apart from the greater and lesser trochanter there is sometimes a third trochanter on the human femur which indicates a recession to a type of structure typical of some lower Primates.

Only man is able to straighten his legs at the knee joint completely and for a lengthy period. The chimpanzee can straighten its legs, but only for a short time.

The phalanges of the great toe of man, the gorilla, the chimpanzee and the gibbons are the strongest while those of the orangutan are much thinner than those of its other toes. The metatarsal bone of man's big toe has an almost flat articular surface proximal to the medial cuneiform bone which does not allow the toe to make the movements that would be possible with a semi-globular joint.

As this flattened articular surface has been found by Lebouck in the human embryo, it is clear that very great influence was brought to bear on the foot of our ancestors during the hundreds of thousands or even millions of years in which they were adapting themselves to erect locomotion.

5. THE PELVIS, SPINE AND THORAX

At the same time as changes took place in the skeletal structure of our ancestors' lower extremities, changes were also taking place in the structure of the pelvic girdle. The sacral-iliac articulation had to become wider and stronger and, therefore, in man and the apes we find five sacral vertebrae instead of the two or three usual in the lower monkeys.

The human pelvis is more developed in the width than in the length (fig. 51) and the blades of the ilium have large fossae in them. In shape the human pelvis approximates that of the gorilla, chimpanzee and orangutan, while that of the gibbons more closely resembles the pelvis of the lower catarrhine monkeys on account of its elongated shape and shallow

fossae in the ilium. In the great apes the length of the pelvic girdle slightly exceeds its width. The widening of the pelvis is directly connected with erect locomotion.

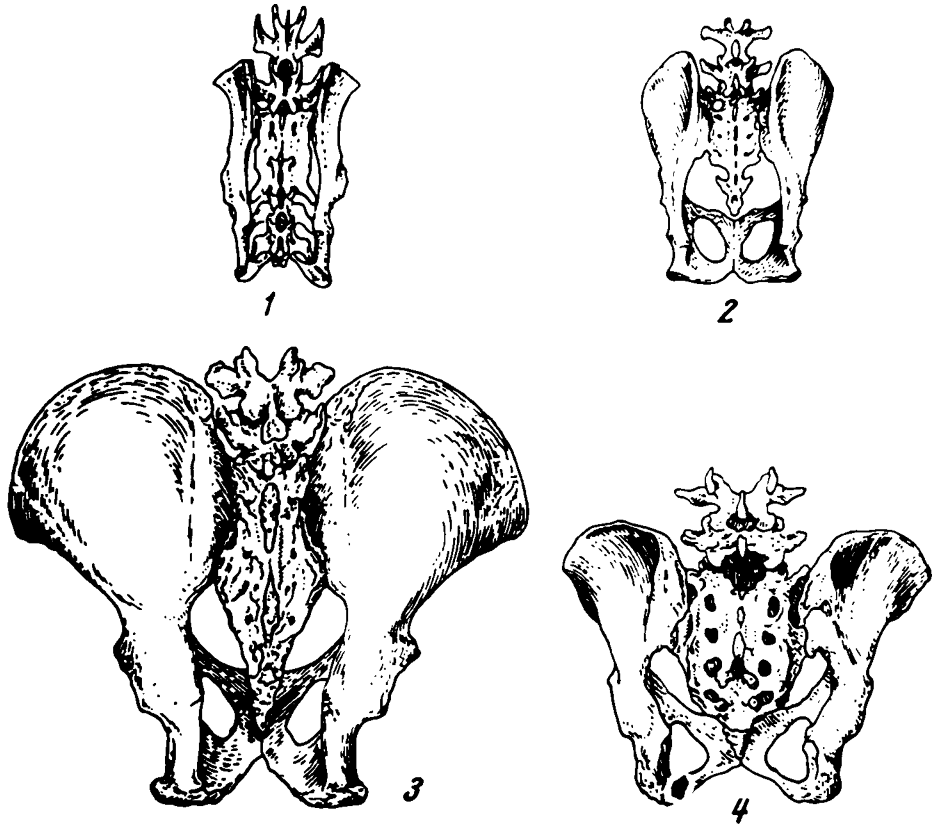


Fig. 51. Pelvic girdles of Primates:
1—gibbon; *2*—chimpanzee; *3*—gorilla; *4*—man. After W. Gregory and M. Roigneaux, 1937.

Man's vertical stance and orthograde locomotion is directly dependent on a number of factors, e.g., 1) the strength and width of the pelvis, 2) the strength of its articulation with the sacrum, 3) the extent of the deviation of the acetabulum, on which depends the angle formed by the neck and diaphysis of the femur (100°-130°) and 4) powerfully developed muscles and tendons of the pelvic region and their special method of attachment.

The shape and structure of the human pelvis underwent considerable evolution on account of the head of the human foetus being much larger than that of the ape or monkey embryo. Typical of the female pelvis is the wider inlet from the pelvis major (bounded by the blades of the ilium, partly by the lumbar and sacral vertebrae and the superior edge of the symphysis of the pubis) into the pelvis minor (bounded by the remaining part of the sacrum, the coccyx, inner sides of the ischium and pubis and by the inferior aspect of the pubic concrescence). The head of the foetus is in the region of the pelvis major until the onset of partu-

rition, when it must pass through the inlet into the region of the pelvis minor. The inlet of the female pelvis is wider than that of the male and the angle is greater between the branches of the pubes that diverge from the symphysis inferiorly and laterally. This structure facilitates the exit of the foetus from the pelvis minor, when the lower part of the sacrum together with the coccyx moves back.

The basic dimensions of the pelvic inlet are: 1) the straight conjugate or antero-posterior diameter (from the middle of the superior border on the interior side of the pubic symphysis to the uppermost protruding point of the corresponding sacral vertebra on the promontorium), 2) the transverse diameter, i.e., the greatest distance across the inlet, and 3) the oblique diameter. All three dimensions are greater in man than in any of the anthropoids except the gorilla (table 2).

Table 2

DIAMETERS OF THE PELVIS IN MAN AND THE ANTHROPOIDS (cm.)

	Conjugate	Transverse	Oblique
Man:			
Male	11	10	10.5
Female	11-11.5	11.5	11.5
Chimpanzee	12	9.5	12
Gorilla	13.5-14	14	14.5
Orangutan	10	9	10
Gibbon	8-9.5	4-6	5-7

Table 2 shows us that only in the human pelvis can the transverse diameter exceed the conjugate; in the anthropoids the pelvis is somewhat elongated in the antero-posterior direction. The smaller pelvic dimensions of the anthropoids correspond to the size of the foetal head, their progeny being born smaller and lighter in weight than human children. Nevertheless, Herman Rohleder (1918), discussing the probability of crossing man with any of the anthropoids, came to the conclusion that in the event of the successful artificial insemination of the female chimpanzee with human semen the hybrid could be born without cesarotomy.

The human pelvis, in addition to its shape, differs from that of the anthropoids in forming a much wider angle with the vertebral column. When the apes assume the erect position the pelvis points downwards, i. e., is in one line with the vertebral column, while that of man is inclined forward and forms an angle of 50°-60° with the horizontal.

The long axis of the pelvis of all Primates except man is more or less parallel to the long axis of the body, as is that of a newborn infant; this latter fact explains the position of the infant lying on its back with its legs raised slightly, bent at the knees and with the soles of the feet turned inwards. This position is also typical of newborn apes. When the infant is lying on its back its pelvis has the ventral side uppermost and the legs and knees can only be forcibly straightened because such an action

causes the spine to bend very considerably. As the child grows the pubic articulation of the pelvis inclines forward in respect of the vertebral column (V. V. Bunak, 1923). Further development gives the pelvis its final shape which serves to support the abdominal viscera as well as the foetus with the placenta, membranes and fluid during pregnancy.

In the lower monkeys that usually move on all fours the weight of the abdominal viscera (in females the weight of the embryo, placenta and fluid must be added) is supported by the lower wall of the abdomen, the pelvis being higher. In the anthropoid apes the pelvis plays a part in supporting the abdominal viscera when the trunk is in a more or less vertical position during locomotion along the branches of trees or on the ground. The same is true of some of the lower Primates (lemur sifaka and tarsier) or the American spider monkey (Ateles E. Geoffroy) and short-tailed monkeys (Cacajao Lesson) for which a more or less vertical position of the body is by no means unusual.

The long process of development in the erect position has still not fully adapted man to this type of locomotion, as can be seen from the frequent cases of hernia caused by lifting or carrying weights and cases of prolapse of the uterus during difficult births, frequent cases of appendicitis, intestinal inversion and other manifestations. During the formation of the human body in the course of anthropogenesis the internal organs were displaced by the force of gravity acting on them in a direction different by 90° from that experienced during the quadruped locomotion of man's most distant ancestors. The method of attachment of the abdominal viscera also changed, especially the attachment of the intestines to the mesentery and the dorsal attachment of the latter.

During pregnancy in women gravity pulls the foetus towards the pelvis and not only towards the abdominal wall as was the case with our ancestors, the extinct quadruped mammals.

The reconstruction of the female pelvis enabled it to perform two functions more or less satisfactorily: it serves as a support for the trunk and at the same time provides a sufficiently wide opening for the large head of the foetus during parturition. In modern man cases occur in which the pelvis outlet does not correspond to the size of the head of the foetus and births in such cases may be of a pathological nature.

Very extensive changes took place in the human spine in the transition to erect locomotion: it was at first curved like that of the lower monkeys, then almost straight like that of the anthropoids, until finally it assumed a number of curves more suitable to support the head, trunk and arms and better suited to dampen the jolts caused by walking. The number of vertebrae in the various divisions of man's vertebral column differs little from that of the anthropoids, but sharply from that of the monkeys with their long tails and quadruped locomotion. The latter have a greater number of vertebrae in the coccygeal division but in the sacral division, where the spine is articulated with the pelvis, their number is smaller (table 3).

Table 3

NUMBER OF VERTEBRAE IN THE DIVISIONS OF THE SPINE OF MAN AND OTHER PRIMATES (FIGURES IN BRACKETS SHOW EXTREME LIMITS).
(DATA TAKEN FROM VARIOUS AUTHORS)

Primates	Cervical	Thoracic	Lumbar	Sacral	Coccygeal	Total
Man	7	12 (11-13)	5 (6)	5	4-6	33-36
Chimpanzee	7	13 (12-14)	3 (4)	5 (6)	3-5 (2)	29-35
Gorilla	7	13 (12-14)	3 (4)	5 (6)	3-5 (2)	29-35
Orangutan	7	12 (11-13)	5 (3)	5	2-3	29-33
Gibbon	7	13 (14)	4	3	1-4	29-32
Old World monkey	7	12-14	7-5	2-3	2-26	29-57
Capuchin monkey	7	13-14	8-5	3	14-26	42-51
Marmoset and tamarin	7	12-13	7-6	3	25	53-55
Tarsier	7	13-14	6	3	21-23 (27)	50-57
Lemur	7	12 (18)	7	3-4	6-20	35-58
Tree-shrew (Tupaia)	7	13	6 (5-7)	3-2	22-28	42-58
Pen-tailed tree-shrew (Ptilocercus)	7	14	5	3	31	60

Table 3 shows that there has been a reduction in the number of coccygeal vertebrae in all groups of Primates except the Hapalidae, tarsiers and tupaias and that the anthropoids have even fewer than man. All Primates have 7 cervical vertebrae as do almost all other mammals. The number of ribs is usually not greater than 13 although the lemurs, as a rule, have 12 and the lorises as many as 18.

The number of lumbar vertebrae in quadruped Primates is greater than in man and the apes but their sacral vertebrae are fewer. The number of the latter was increased by a reduction in the number of lumbar vertebrae and provides a stronger sacro-pelvic articulation. Of the Lemuroid group the Indriidae have four sacral vertebrae instead of three: these prosimians include the sifakas (Propithecus Bennet), an animal with short fore limbs that usually moves in the erect position both in the trees and on the ground. The number of vertebrae in man and the anthropoids is always within the 32-36 range, although in other Primates it is nearly always over 50 and in the tupaias is as high as 60.

Man's vertebral column has a series of very specific curvatures, of which there are four—cervical, spinal or thoracic, lumbar and sacral (the latter includes the coccyx). A curvature of the spinal column with forward convexity is called lordosis and the backward convexity is called kyphosis. Some people have slight curvature to the right, others to the left in the thoracic division of the vertebral column. Such lateral curvature is called scoliosis and is usually slight and within the bounds of physiological norms; the same applies to lordosis and kyphosis. When highly developed all three produce deformities of the trunk.

The curvatures present in man's spine are the direct result of the straightening of his body. In the course of individual development cervical lordosis develops when the infant begins to hold up its head, and

lumbar lordosis comes late, when the child begins to walk on two legs (V. V. Bunak, 1940).

The vertebral column of quadrupeds is adapted to a different sort of locomotion both in the pronograde animals whose trunk is in a horizontal position and in the orthograde (e.g., the anthropoid apes) whose bodies are in an inclined or erect position, depending on their method of terrestrial and arboreal locomotion. The vertebral column of the lower monkeys and half-monkeys has only cervical and thoracic curvatures whose development is mainly due to the method of holding the head. In other words, the vertebral column of the majority of the Primates has the form of an arch usual for quadruped Mammalia. The lumbar and sacral curves are met with only in the anthropoid apes and are very slightly developed; the cervical and thoracic curves in these animals are also less clearly expressed.

During quadrupedal locomotion the spinous processes of the vertebral column usually point backwards, the remainder pointing forwards. The projections change direction on one of the vertebrae which is known as anticlinal. The lemurs, tarsiers and lower catarrhine monkeys usually have an anticlinal tenth vertebra while in the New World monkeys the place varies but is usually in the lumbar division of the vertebral column.

The human skeleton not only differs greatly from that of the apes by the peculiarities of the vertebral column; there are also great differences in the shape and structure of the thorax, the pectoral girdle and the upper extremities.

The human thorax consists of 12 pairs of ribs and a sternum with which only 7 pairs of ribs articulate (the upper or true ribs); the 8th, 9th and 10th pairs (false ribs) are attached to the 7th and to each other by costal cartilages; the 11th and 12th pairs (the floating ribs) are unattached anteriorly and are very short, especially the lower pair, a phenomenon that is noticed in other Primates as well as in man.

In the human embryo 13 pairs of ribs develop, a peculiarity that approximates man to the chimpanzee and gorilla, but the latter both have the same number of ribs in the adult stage (the gorilla, more often than the chimpanzee may have 12 pairs of ribs). The 13th pair of ribs is reduced in the human foetus. Some adult humans possess 13 pairs and the extra pair (or single rib) usually grow from the first lumbar vertebra, more rarely from the seventh cervical. There was a case in Holland of 13 pairs of ribs having been discovered in several members of the same family.

K. Kühne (1925) distinguishes types of vertebral column that vary cranially and caudally. To the first type belong cases of variations in the number of vertebrae in the upper division of the spine, e.g., cases of a seventh cervical rib. Kühne places cases of ribs on the nineteenth vertebra, i.e., the first lumbar vertebra, in the second category.

In the course of evolution the thorax of our ancestors had the number of ribs reduced from 13 to 12. It also became wider and flatter. In the

human foetus the transverse diameter of the thorax is greater than the antero-posterior diameter, in the infant they are almost equal and in the adult the former again exceeds the latter (see the investigations of N. V. Popova-Latkina, 1957).

The sternum consists of three segments: the body, the manubrium and the xiphoid process. The body of the sternum in anthropoids and in man is short and wide and its division into segments is usually more noticeable. The sternum of the lower monkeys has a rod-like shape and the segments of its body are clearly defined, the thorax is usually well rounded, although in the majority of cases is not so narrow as that which is typical of ground-living quadrupeds. The arboreal life of Primates has given their arms a wider range of movement than those of many other arboreal animals.

The clavicles articulate mediad with the manubrium of the sternum and laterally with the scapulae with which they form the shoulder girdle. The presence of the clavicles is typical of all Primates and is a point in which they differ from many other mammals. The ungulates, for example, do not possess a clavicle due to the development of a specific means of locomotion employing highly specialized extremities that move in an antero-posterior direction.

The scapula or shoulder-blade of man is wider than it is long, a feature that is, to a lesser degree, also typical of anthropoid apes. In other Primates its length is greater than its width (A. K. Koveshnikova, 1928). The scapula lies in a bed of muscles that make possible the very diverse movements that only the arm of man can perform.

6. THE SUPERIOR EXTREMITIES

The bones of man's upper extremities are much thinner than those of his lower limbs.

The upper extremity has three divisions—the arm, the forearm (consisting of the radius and ulna) and the hand (consisting of the 8 carpal bones of the wrist, the 5 metacarpal bones and the 14 phalangeal bones of the digits). The latter have 3 phalanges each with the exception of the thumb which has only two.

The longest of man's fingers is the middle or third finger, followed by either the fourth or the forefinger, the little finger and the thumb being the shortest. The most usual digital formula is $3 > 4 > 2 > 5 > 1$ and is the same as that of the apes. When the fourth finger is longer than the forefinger the hand is said to be ulnar and when the reverse is the case it is radial. These names have been adopted because the third finger is on the side of the ulna and the forefinger on that of the radius.

To determine the type of hand it must be held with the long axis of the middle finger forming a direct continuation of the long axis of the forearm: if the hand is inclined outwards the third finger may be level with the middle finger.

The radial form of hand is common to children in the first years of life, whereas the ulnar form predominates in adults (data by M. V. Volotskoi, 1924). The ulnar form is typical for all apes except the gibbons among whom 75 per cent have the radial form. According to L. P. Astanin's data, the typical human hand has a strengthened radial division, especially the first arch, the fingers are long relative to the metacarpals and the distal phalanges have become thickened by work (Astanin, 1951, 1952).

In many respects the human hand is the not very greatly changed grasping extremity of the anthropoid ape. All the digits are furnished with well-developed flat nails. The narrowest nail is on the little finger, the others are even broader than those of the gorilla. The dynamics of the human fingers are highly differentiated, there is great independence of movement in each of them, a feature in which man differs greatly from the other Primates. Even the digits of the anthropoid hand are more dependent on each other in their movements.

The human shoulder articulation, allowing the circumduction of the arm, is more highly developed than that of the apes. The rotation of the forearm, moreover, permits man to make a much more complete circular motion with the hand—the movements of pronation, palm downwards, and supination, palm upwards (V. P. Yakimov, 1946; M. A. Gremyatsky, 1941).

These movements of the hand and arm are essential to many forms of work; man has the greatest range of movement and agility.

Man's wrist, like those of the chimpanzee and gorilla, has no free central bone such as that which forms a separate element in the wrist of the orangutan and the gibbons; the Asiatic apes, therefore, approximate the lower monkeys in this respect.

Table 4

LENGTH OF THE DIVISIONS OF THE UPPER (FORE) EXTREMITIES IN PERCENTAGES OF THE LENGTH OF THE TRUNK IN MAN AND THE OTHER PRIMATES

Primates	Upper Arm	Forearm	Hand
Inhabitants of Baden:			
Men	65 (57-73)	50.9 (45-59)	36.8 (32-43)
Women	61.5 (44-76)	46.5 (38-62)	35.7 (30-45)
Gibbon	90.7 (81-103)	97.8 (83-113)	58.1 (48-72)
Orangutan	81.8 (76-95)	78.4 (73-91)	63.4 (56-71)
Gorilla	73.0 (70-76)	60.5 (59-62)	55.0 (53-57)
Chimpanzee	73.5 (58-68)	59.1 (56-61)	57.5 (51-62)
Guenon, mangabey and leaf-monkeys	42.5-39.5	45.0-38.2	29.7-26.0
Rhesus monkey	50.0-42.5	51.6-42.0	38.1-31.4
Baboon	54.6-49.0	57.2-53.6	37.0-31.9
New World monkeys	46.0-36.6	46.0-31.7	29.0-26.6
Spider monkey	72	68	51
Lemurs	39.3-31.7	38.3-32.0	29.4-25.7

The length of man's hand is only about a third of that of his trunk; the same is true of the hand of the rhesus monkey and the baboon. Other lower catarrhine monkeys, the New World monkeys and the lemurs, have a hand that is less than one-third of the trunk, the spider monkey's is a half, that of the great apes from one-half to two-thirds, and that of the gibbons almost three-quarters of the length of the trunk.

The length of man's forearm and upper arm, the latter being longer than the former, approximates that of the gorilla and the chimpanzee. In the other Primates there is little difference and the forearm may even be somewhat longer than the upper arm, especially in the case of the orang-utan whose arms are one and a half times, and the gibbon whose arms are twice the length of the trunk (see table 4: data taken from R. Martin's book, 1928).

An interesting atavism is occasionally found in the human humerus—the entepicondyloid foramen which is typical for the majority of Primates. It is found in the tupaias, almost all the lemurs (except, perhaps, the Artocebus Gray), the tarsiers, some of the Hapale, especially the lion marmoset (Leontocebus rosalia Linnaeus), in all the cebus monkeys except the spider monkeys (Ateles), brown woolly spider monkeys (Brachiteles-Ateles arachnoides E. Geoffroy and allied forms) and the howlers (Alouatta). This foramen is not found in the other lower (catarrhine) monkeys or in the anthropoids. In those cases where it is found in man it normally consists of a pair of bony projections joined by a tendinous band. The brachial artery and the medial nerve usually pass under the band as in the Primates in which it is usually present.

A specific feature of the human humerus is the very considerable twist or torsion, relative to its long axis, in the proximal part of the bone. The articulating surface is turned inwards because the scapula has its joint cavity turned laterally more than downwards, the latter position being common to all other Primates. This torsion of the humerus is found only in man and the anthropoid apes, but in the latter it is not well developed.

Man's descent from an arboreal pithecoid type is manifested not only in the adult. The manual prehension of a newborn infant, for example, is astonishing; the child can hang for a long time with its fingers grasping a stick or a finger, as has been established by Henry Drummond, L. Robinson and other investigators. Drummond studied 60 children at ages varying from one hour to one month from birth. All the children remained suspended in the air more than 10 seconds, holding on to a stick 2 cm. thick or to the investigator's finger. An infant that has just been born is capable of hanging from 30 to 60 seconds. Infants three weeks old showed the greatest ability—many held on for $1^1/_2$ minutes and in individual cases as long as 2 min. 35 secs. They hung in the air with their legs bent at right angles to the body. The infants did not display any signs of fear and only cried out when strength failed them (R. S. Lull, 1929).

By observing monkeys one sees that they use their fore limbs for the prehension of food as well as for climbing. They use the hands to tear the rind off fruits and to carry food to the mouth; they pick up various objects and hold them close to the eyes and study them attentively. When in repose a monkey uses its hands to search energetically for insects and thorns in the fur of another. The monkey's hind limbs serve mainly as organs of support and locomotion, but in many cases the monkeys use them to scratch themselves, to grasp food and to perform many other acts.

In the early stages of transition to the erect posture our ancestors most likely made frequent use of their fore limbs in locomotion. Their direct participation as supports when walking or when standing still on the ground gradually decreased until it finally ceased altogether. Biped locomotion, on the other hand, provided the upper extremities with new functions which must be especially linked up with the use of natural objects as tools. The later manufacture of artificial tools had a still greater effect on the development of the hand.

Engels gives the hand, as the work organ, an extremely important part in the further development of man.

The hand itself was transformed and perfected as man transformed his environment. Engels says: "Thus the hand is not only the organ of labour, *it is also the product of labour*. Only by labour, by adaptation to ever new operations, by inheritance of the thus acquired special development of muscles, ligaments, and, over longer periods of time, bones as well, and by the ever-renewed employment of these inherited improvements in new, more and more complicated operations, has the human hand attained the high degree of perfection that has enabled it to conjure into being the pictures of Raphael, the statues of Thorwaldsen, the music of Paganini."*

Although the human hand has retained points of great similarity with that of the apes, its powerful, easily opposable thumb and the strongly differentiated (in the functional sense) fingers make it a specific and highly perfected organ.

The multitude of delicate and varied operations that the human hand can perform are far beyond the scope of the ape hand (fig. 52), because of its somewhat different structure and innervation and also because of the differences in the central nervous system. Some physiologists have studied the action of electric current on the motor region of the upper extremity and its fingers in the precentral convolution of the frontal lobe of the cerebral cortex. The experiments showed that it is exceedingly difficult to get a monkey's forefinger to bend without causing any movement of the second and third fingers, whereas it is a comparatively simple matter to bring about the isolated action of the human forefinger. In this respect the great apes also show less ability than man. In the early stages of man's evolution his hand was poorly developed: it was capable

* F. Engels, *Dialectics of Nature*, Moscow 1954, p. 230.

Fig. 52. Hand (left) and foot of chimpanzee.
After A. Schultz, 1936.

of only the simplest manipulations that differed little in character from the ape's manipulation of natural objects. Very gradually, over an extremely long period, as the ape became a man, work operations grew more complicated as the hands became more perfect.

Pre-human forms of work, in distant Pliocene times, were of an animal nature. In the search for food or in defence against beasts of prey, man's ancestors instinctively grasped a stick or stone that was lying handy and used it as a tool or a weapon.

As the manipulation of natural objects as tools became regular and customary, certain stones or sticks proved more convenient for their purpose. For example: a stone whose edge had been chipped in use could become so sharp that its value as an instrument of offence or defence suddenly increased. Such instances could have led our ancestors to the deliberate treatment of natural tools. The oldest techniques of stone-working, however, developed with extreme slowness.

The development of work techniques would have been impossible unless the hand had been freed of the task of supporting the body, but it would have been equally impossible without the further adaptation of the legs to support the body in a vertical position. Erect locomotion, in turn, brought about a reconstruction of the organism, and its progressive development is a typical feature of man's physical evolution. Ancestral man was first able to walk on two legs, because the upper extrem-

ities of his ancestors had not been so well adapted to walking as his lower extremities. The new functional activities of the upper extremities, therefore, must be regarded as one of the most important circumstances facilitating orthograde locomotion. The liberation and transformation of the arms, therefore, acquires the significance of the central moment in anthropogenesis insofar as the hand constitutes the organ of work, and social labour, in turn, created man.

In the course of anthropogenesis the human organism underwent great structural change relative to the fossil ape organism from which it evolved. In the end the organism of the Hominidae reached the peak of its development in modern man, *Homo sapiens*, in whom the main specific structural features are: a markedly curved vertebral column with four curvatures; a skull, balanced on the vertebral column, with a much larger cranium and smaller facial region; a highly developed brain, especially the cerebral cortex; a highly developed external nose; a wide chest, flattened in the antero-posterior direction; a highly differentiated hand as the organ of work and foot as a support for the body; many muscular peculiarities that characterize the musculature as having been adapted to hold the body in the erect position; a wealth of facial muscles capable of a variety of expressions.

The ancestors of man could not have gone over to a biped gait without a considerable reconstruction or adaptation of the muscular system of their lower extremities and trunk; great changes also took place in the muscles of the upper extremities, the neck and the head.

The muscles of the anthropoid apes are well developed, and very resilient but do not stand out in relief. The muscles of the chimpanzee have greater lifting power than those of man. The gorilla has greater physical strength than any of the other Primates; the muscular system of the anthropoids, however, is adapted to tree climbing and differs from that of man, adapted to erect terrestrial locomotion.

There are some muscles necessary for tree climbing that are strongly developed both in the apes and in the lower monkeys, such as the scapular-cervical muscles and those connecting the upper arm and back. These are not found in man except in rare cases, and then only in a rudimentary form. But in man's upper extremities there are independent thumb muscles (abductor pollicis longus) that in the majority of apes are more or less closely linked with the common flexor muscles of the fingers. Due to the erect posture on only the lower extremities the plantar muscles of the foot have been greatly reduced, but the gluteal femoral and sural muscles have all progressively developed.

The development of new elements in man's muscular system took place parallel to the reduction of others. One of the many examples that could be given is the reduction of the caudal and the powerful development of the gluteal muscles.

The muscular system of modern man and the skeleton to which it is attached have changed together in the course of evolution and make

possible the present more evolved type of biped gait. Man's erect posture in walking is, from the standpoint of biomechanics, a very original type of locomotion. The legs, owing to the corresponding structure of the hip- and knee joints, are in one line with the body (and not at right angles, as in the quadrupeds) when a man is standing upright. The head is well balanced on the spine, due to the special attachment of the skull to the neck.

7. THE PROPORTIONS OF THE BODY AND ASYMMETRY

As our ancestors' gained proficiency in erect locomotion the human body developed proportions that differ greatly from those of the ape (some of these peculiarities have been discussed above). Typical of man are shorter upper and longer lower extremities than those of the ape whose fore limbs are longer than the hinds. When we study the relationship between the length of the legs and trunk we see that man's legs are relatively longer than the ape's.

Hind limbs that are longer than fore limbs are the general rule among Primates. The tarsiers and the sifakas lemurs possess extremely short fore limbs as compared with their hinds and bear some resemblance to the jerboa (Alactaga) and kangaroo. Long hind and short fore limbs are found (apart from the anthropoid apes) only in the American spider monkeys (Ateles).

In respect of the relative length of the legs as compared with the trunk, the spider monkey, gibbon and orangutan most closely approximate man; the chimpanzee and gorilla are further removed; on the other hand, in respect of the relative length of the upper extremities (expressed as a percentage of the length of the trunk) the gorilla and chimpanzee more nearly approximate man and the orangutan and gibbon are further removed. Schultz (1934), studying the differences between mountain and coastal gorillas, found that the former had shorter arms than the latter and even went to the extent of calling them "short-armed." The sharp differences between the proportions of the body of man and the anthropoids are partially absent in a newborn child: the infant's arms are longer than its legs, the reach of the arms is greater than the length of the body and the trunk is longer than the arms or legs.

Apart from length relationships it is important to examine the width ratios, especially those of the thorax and pelvis. In this field man forms a single group with the anthropoid apes on account of his broad chest and pelvis: the whole group is to some extent orthograde, thus differing from the other Primates. As far as the development in the breadth is concerned the gorilla is closest and the gibbon furthest from man. Erect locomotion has given man a wide pelvis with legs far apart at the hip joint to ensure stability of stance and motion.

The female pelvis, wider than that of the male, took form during

the adaptation of the female organism to childbearing; at the same time the extremely wide female pelvis is the cause of somewhat reduced stability during fast movement and of a moderate knock-kneed posture that is typical of many women.

It is quite probable that the simian-like ancestors of the anthropoids and man were apes with fore limbs relatively longer than the hinds. This difference later increased to a greater degree in the ancestors of the gibbons and orangutans but did not reach such proportions as those of the common ancestors of the gorilla, the chimpanzee and man. Man's later ancestors came down from the trees and adopted a terrestrial way of life and this led to locomotion on the hind limbs. Natural selection gradually changed the proportions of their extremities until they were the reverse of those of the anthropoid apes.

Erect locomotion and work have brought about many points of asymmetry in man's body and these constitute one of his distinguishing features. It has long been known that the right and left halves of the human body are not fully symmetrical in shape and structure. Take, for example, man's face: the right and left halves quite frequently have noticeable differences. If two full face photographs, one of which has been printed from the reverse side of the negative, are cut, and the left and right halves joined together, pictures of the "left" and "right" faces can be obtained. In many cases the right and left photographs of the face are so different that they could be taken for those of two different people.

A good example of the combination of morphological and functional asymmetry is to be found in man's hands. The majority of people are right-handed, there being, perhaps, no more than 2 to 5 per cent of left-handed people. Among children the number of left-handed is much higher, up to 10 per cent while some investigators maintain that as many as 25 per cent of all infants are left-handed (Wilhelm Ludwig, 1932). Up to the age of seven months the child is usually ambidexterous. It becomes right- or left-handed during the first seven years of its life. Training and the use of various articles and instruments adapted for use only with the right hand, however, compel congenitally left-handed children to become functionally right-handed.

The priority use of the right hand affects its structure and the right arm may become longer than the left by several millimetres or even centimetres. The preferential use of the right hand affects the structure of other organs, particularly that of the brain. The corresponding zone, situated in the left hemisphere of right-handed people, has a more strongly developed cortex. In left-handed people it is, by nature, somewhat underdeveloped as compared with the corresponding zone of the right hemisphere.

It is difficult to observe any preferential use of any one hand in the apes. Some investigators report right-handedness in the anthropoids. Viktor Henschen (1926), for example, mentions the fact, reported to

him by Karl Hagenbeck, that a gorilla in Hamburg Zoo used its right hand for throwing. By a study of the skulls of gorillas Henschen draws the conclusion that the left cerebral hemisphere is more developed than the right in many individuals. More recently, G. Z. Roginsky (1953) reported that some monkeys make preferential use of the right hand which is stronger than the left (the same is true of apes. Cf.G.Lefrou, 1956).

Monkeys are, as a general rule, ambidexterous. They use both hands with more or less equal frequency. The equal use of both fore limbs is also typical of all other mammals. It seems likely that in various work processes, in offence and defence and in hunting the preferential use of the right hand became, for some reason or other, more convenient and this had great significance in the development of right-handedness (Kobler, 1932).

Apart from being dextro- or sinistromanual man may be dextropedal or sinistropedal. This form of asymmetry depends on which foot has preferential use in standing or walking. In dextropedal people the right foot is usually more developed and longer. This is partially explained by the fact that erect locomotion facilitated and is today still affecting the preferential use of one of the feet. It is known that fatigue is felt less when the weight is brought to bear on one particular leg; quadrupeds support their weight more or less evenly on the right and left limbs.

Schultz (1937) studied the asymmetry of extremities on the skeletons of 753 people and 530 higher apes and macaques. The percentage of distribution and relative number of asymmetric manifestations in the long bones of the upper (or fore) extremities (and clavicles) was found to be greatly different for human beings and monkeys. In the lower (or hind) extremities the percentage of asymmetry was found to be the same for man, the apes and the lower monkeys. Schultz rightly assumes that the preferential and regular use of the right or left hand is observed only in man and that it is incomparably more frequent and more intense than the use of one particular leg when standing or walking. Asymmetry is much more strongly developed in modern man than in any ape and is found in many organs, including the eyes.

A good example of anatomical and physiological asymmetry in man may be observed when people lost in the open in a snow-storm or in complete darkness walk in a circle and return to their starting-point. The same thing happens to a man who loses his way in a thick forest or a swimmer in the open sea if he has no means of judging the points of the compass. A right-handed man will wander to the left, counterclockwise, while a left-handed man will move to the right, in a clockwise direction.

The development of erect locomotion that accompanied the transition of our ancestors to life in open country had great influence on the construction of the entire organism, including the features of asymmetry that are so numerous in the human body.

No less important in the humanizing of the ape than erect locomotion was the great development of the brain in our immediate ancestors, the biped great apes that lived at the end of the Tertiary Period. If the brains of those apes had not, by that time, reached a comparatively high level of development, it is improbable that they would have turned to the use of tools even in the exigencies of the struggle to obtain food and ward off beasts of prey, and it is improbable that they would have provided material for the making of man. The housing of the brain, the skull, has undergone a most peculiar evolution under the influence of erect locomotion, the development of the brain and changes in diet.

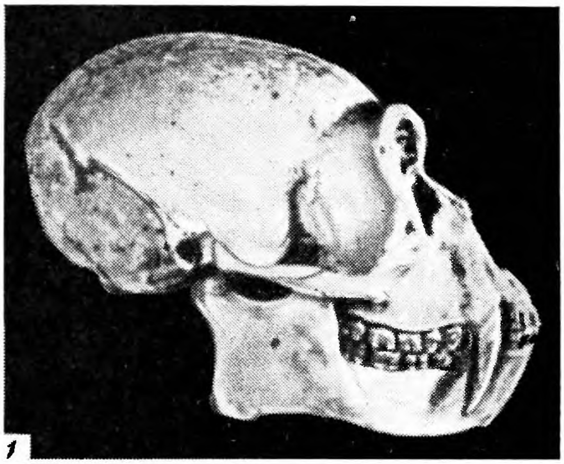
8. THE SKULL

The basic difference between the skull of man and that of the other Primates consists in the neurocranium being considerably larger than the facial region. Only one New World monkey, the squirrel or death's head monkey (Saimiri Voigt), for example, has a skull approximating that of man; this is due to the foramen magnum being situated nearly in the centre of the occiput and there is a brain-case that is much larger than the facial skeleton. The howling monkeys, baboons, orangutan and gorilla, on the contrary, have a muzzle that is much larger than the neurocranium.

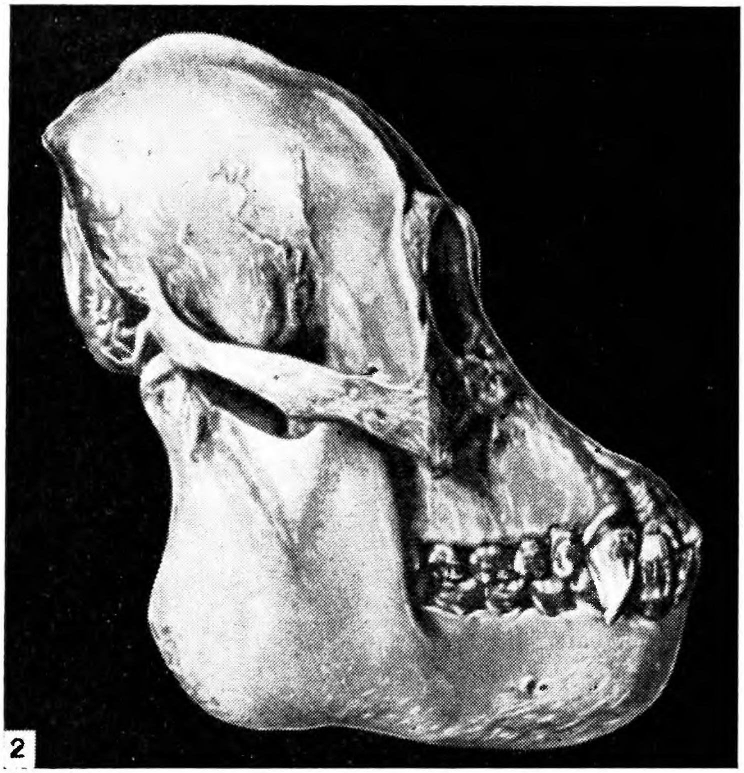
Modern man's skull has very little external relief. This is particularly true of the female skull that can, in the majority of cases, be easily distinguished from the male by its comparatively thin bones, lighter weight, and pronounced frontal protuberances with rounded contours. The skulls of the chimpanzee and the gibbon have a less strongly expressed relief than those of other anthropoids, as have also the female orangutans and gorillas, but the males of these giant animals possess massive skulls with a framework that consists of crests, bony bars and arches (figs. 53a and 53b).

Man's temporal bone has a number of typical, strongly developed mammiform (mastoid) and stylus-shaped (styloid) processes that are not found in most of the other Primates. The external osseous auditory canal is much shorter in man than in the apes. The greater part of the temporal bone has a rough surface; the temporal masticatory muscle has its origin here and on the parietal bone and is joined to the coronoid process of the mandible. Male gorillas and orangutans have very strongly developed temporal muscles that not only originate from the temporal and parietal bones but also from the longitudinal (sagittal) crest that in some individuals is as much as 5 cm. high, and also from an occipital transverse crest that is almost as massive.

The antero-superior edge of the temporal bones forms part of the pterion, the typical junction of sutures with its specific pattern that is formed in different ways in the vicinity of the temporal fossa on the skulls of different Primates. In the tupaias, lemurs and tarsiers the

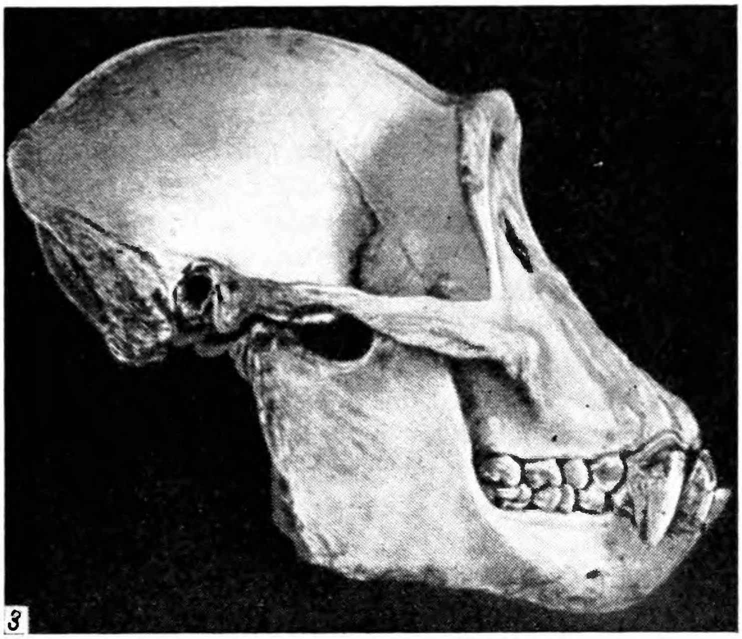


1



2

Fig. 53a. Skulls of Asian anthropoids:
1—gibbon (Hylobates lar L.); *2*—Bornean orangutan (Simia satyrus L.).



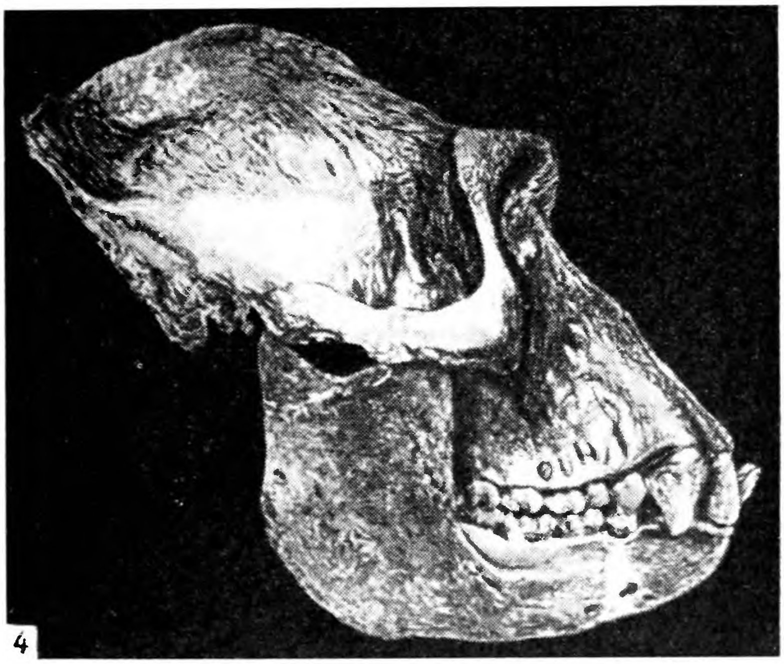


Fig. 53 b. Skulls of African anthropoids:

3—Cameroons chimpanzee (Pan vellerosus Gray); *4*—coastal gorilla (Gorilla gorilla Savage and Wyman). $^1/_2$, $^1/_3$, $^1/_3$, $^1/_4$ natural size. After D. Elliot, 1913.

junction of the temporal bone with the alisphenoid, or great wing of the sphenoid, is typical; in New World monkeys the zygomatic bone often makes contact with the temporal. In the majority of lower Old World monkeys the temporal bone joins the frontal which separates the temporal from the great wing of the sphenoid and from the zygomatic; this structure of the pterion is frequently observed in the gorilla and chimpanzee but rarely in the orangutan or gibbon.

In the majority of cases the pterion in man is a suture formed between the temporal bone and the alisphenoid or great wing of the sphenoid. In this respect the gibbon and orangutan more closely approximate man, the gorilla and chimpanzee being further removed. It is probable that the pterion has no great independent philogenetic significance, but is more likely a reflection of general processes taking place during the reconstruction of the skull (Weinert, 1932). In Primates the pattern of the pterion to a certain extent depends on the level of development of the zygomatic.

M. F. Ashley Montagu (1933) notes the importance of the level of development of the zygomatic bone for the formation of the pterion. By the study of several thousand skulls belonging to various Primates, from the tupaias to the anthropoids and man, he established sixteen basic types of pterion structure. In particular, Ashley Montagu found that the shape of the tupaia pterion is similar to that of the lemurs and that of the gorilla to that of man. Other investigators note the influence that the development of the temporal region of the brain in Primates has on the formation of the pterional region. In the same way the powerful development of man's parietal bone has brought about the separation of the frontal from the temporal bone.

The protuberances on the frontal bone are typical for man; also typical are the weakly developed supra-orbital ridges that differ so greatly from the massive bony bar or supra-orbital torus found on the skulls of the gorilla and chimpanzee, as well as those of the Pithecanthropus and Neanderthal man, the ancestors of modern man. It sometimes happens that the metopic suture of the frontal bone does not close but remains open as in the uterine period of life. The metopic suture is usually found on the skulls of the lower Primates and its appearance in man may be regarded as an atavism. On account of the growing capacity of the human brain-case, however, the appearance of the metopic suture has partially the character of a new formation (Uryson, 1952).

There is a large opening, the foramen magnum, in the occipital bone, almost in the centre of the skull base. When the skull is in a certain position, known as the Frankfurt or German horizontal position, with the upper edges of the auditory orifices and the lower edges of the orbits in a horizontal plane, the foramen magnum is also more or less horizontal, although in the majority of cases it is inclined slightly forward. It is placed further back in the anthropoids but does not

reach the raised edge of the occipital bone. The lower monkeys and the other Primates and mammals have the foramen magnum a long way back and more or less strongly inclined posteriorly.

The horizontal position of the foramen magnum shows that man is able to keep his head balanced with the aid of neck muscles that are relatively less powerful than those of the anthropoids. For this reason the human skull has no saggital crest such as that observed in a highly developed form in the male gorilla and orangutan. It is true that some human skulls, mainly male, have a noticeably developed occipital crest fusing with the exterior occipital protuberance and the nuchal (nape) lines and corresponding to the occipital crest of other Primates.

The facial region of man's skull has many features that are typical. We must make special mention of the considerable development of the paired nasal bones, the inferior parts of which project slightly forward and, as a rule, are not joined; this is a specific feature of the human skull. The nasal bones of all monkeys, including the anthropoids, grow together at a very early age, usually in the pre-natal period. The development of man's nasal bones in the width more closely resembles that of the chimpanzee or gorilla; in the orangutan they are narrower and their long pointed ends even penetrate the frontal bone.

On the left and right maxillae, below the zygomatic bones, there are depressions known as the canine fossae. These are not found in fossil man or in the apes and monkeys. In the human embryo four bones are formed in place of the maxillae—two maxillary and two incisor bones (corresponding to the intermaxillary bones in other mammals). At the time of birth, however, there is usually no trace of an incisor bone suture.

As early as the eighteenth century anatomists noted the absence of an incisor bone in man as one of the ways in which the structure of his body differs absolutely from all other mammals. Even then, however, there were some scholars who had noticed that the human skull, on rare occasions, showed traces of incisor sutures on the hard palate indicating the division of the maxillary into three parts. Still less frequent are cases of a suture between the incisor bone and the maxillary bone on the anterior side. The honour of discovering the incisor bone on the skull of an adult is usually given to Wolfgang Goethe, the great poet and scholar. Although traces of the incisor bone are rarely found on the skull of an adult, it is clearly seen as a separate bone in the uterine period of development and may be regarded as being identical with the intermaxillary bone in other mammals.

The lower jaw or mandible of modern man has a horseshoe shape and is furnished with a clearly defined chin protuberance. The other Primates, with the exception of the web-toed gibbons or Siamangs (Symphalangus Gloger), there is not even the suggestion of a chin and the two halves of the mandible either form an acute angle or they are parallel to each other. The two parts of the lemur's mandible remain

unsutured throughout the animal's life. The fossae for articulation with the coronary processes of the mandible are much deeper in man than in the anthropoids.

The greater development of the brain-case and lesser development of the facial skeleton is typical for hominids and is the final stage of evolution in fossil mammals in which the inverse proportions of the skull were normal. The evolution of the skull of fossil anthropoids had also been going on for millions of years; evidence of this is to be seen in the many finds that have been made, from the Proconsul and Dryopithecus to the Australopithecus. As the features typical of anthropoid apes, such as the chimpanzee and gorilla, grew less pronounced—e.g., the sloping forehead, the heavy supra-orbital torus and the powerful mandible—the specific features of the hominid skull took shape as the brain developed, the jaws weakened and there was a progressive development of erect locomotion.

The apes, on their part, inherited many of the specific features of the skull, especially the facial region, of the primitive fossil mammals and still more ancient reptiles, amphibians and fish. William Gregory (1936) is quite right in saying that although the ignorant Hebrew priests maintained that man was created in the image of God, modern science has shown that the human face consists of the same elements as that of the gorilla and that the skeleton of the face of both man and the anthropoids is inherited from a long line of lower vertebrates.

The skull of the male orangutan and gorilla, if one may judge by the strongly-developed facial region, the heavy bony crests on the cranium and the external relief in general, is the culminating point of one line in the development of higher Primates while the human skull is the highest development in the opposite direction. The development of crests and muscles on the skull is due to a number of different causes among which the more important are the dimensions of the animal's body, species and sex differences, the type of locomotion and diet (V. V. Bunak, 1923). The ability to bite through the hard skins of fruits or chew the hard parts of plants depends on the powerful development of the mandible and its muscles which, in turn, requires a thickening of the vault of the skull and an earlier suturing of its bones as well as stronger bony ridges. All these things, taken together, limit the free development of the brain.

Among the higher ape-like Primates, the gibbons, the chimpanzee and man stand out as a separate group. The gibbons, when moving in the trees or on the ground, hold their bodies in a more or less vertical position. They are, furthermore, rather small, and, as we have already seen, grow to a height of only 90-100 cm. with a weight of 5-18 kg. The gibbon's head is held in position by weaker muscles. The chimpanzee, whose skull is smaller than that of the gorilla or orangutan, possesses a less strongly developed facial region and a less powerful muscular system to hold the head in position. The chimpanzee, moreover, like

other anthropoids, frequently moves in a semi-erect position and not like a typical quadruped. From this it follows that the comparatively weak relief of the chimpanzee's skull is partially to be explained by the dimensions of its body and the type of locomotion common to it (V. I. Kochetkova, 1953).

Of the lower monkeys, let us examine the baboon. The skull of this terrestrial monkey has a strongly developed snout or facial division and a poorly-evolved brain-case; the South African baboon (chakma), for example, has a small cranium and especially powerful jaws. The baboon has a thickened cranial vault on the exterior surface of which are noticeable ridges for the attachment of strongly developed masticatory and other muscles.

The masticatory muscles of the baboon are very strong. They are attached to the zygomatic, temporal and parietal bones; the cranium is noticeably rough and there are ridges and even crests, especially in the males, who are much larger than the females. The masticatory muscles close the jaws with their strong teeth very tightly and are sufficient to enable the baboon to deal an enemy a dangerous or even a fatal bite. The inhabitants of Africa often have to turn out in a body, well armed, to defend their village against plundering baboons. Despite the persecution, however, the baboons constitute a flourishing biological group.

The head of the baboon, furnished with strong jaws and a long snout, has powerful neck muscles that hold the head in a horizontal position. This powerful group of muscles is attached to the many rough surfaces, bony ridges and crests on the occipital and parietal bones of the skull.

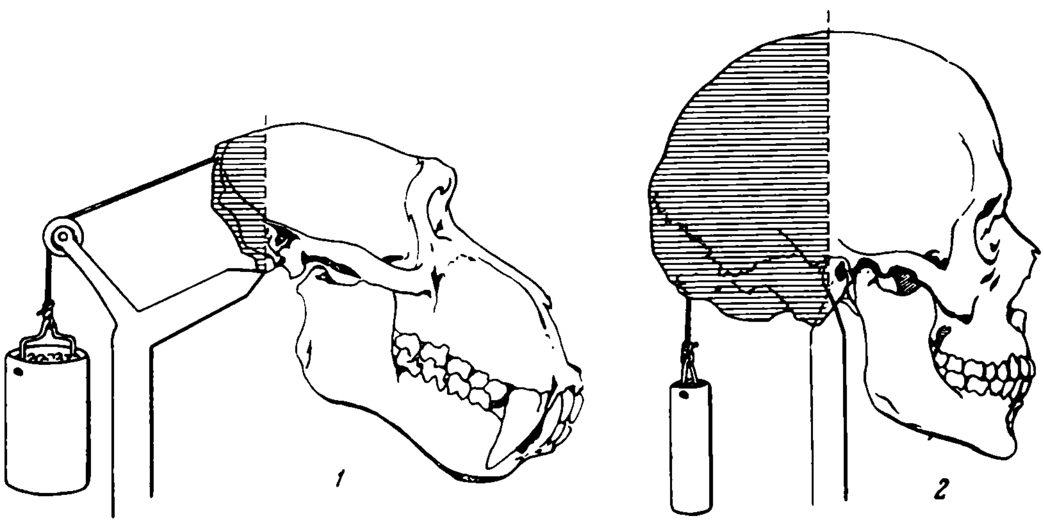


Fig. 54. Skulls:

1—baboon; *2*—man. Weights show difference in muscular strength required to hold the head on vertebral column in its normal position. Diagram by Th. Mollison, 1923.

The structure of the baboon's skull, therefore, differs greatly from that of man. In comparing the skulls of the baboon and man special stress is laid on the importance of the dimensions of the body, the type of locomotion and the food habits (fig. 54).

W. D. Wallis (1931), a British scholar, considers that the evolution of man's skull in prehistoric times was primarily due to changes of diet and the way of life. In particular, he says, many of the specific features of man's skull developed under the influence of changes in the properties of food artificially prepared. The action of fire made the food softer and also brought about changes in its chemical properties. Wallis' idea is worthy of attention (see also article by Khrisanfova, 1958).

Food that has been artificially prepared and softened can be assimilated by a masticatory apparatus that is not very strongly developed. Tools gradually play a more and more important part by replacing man's teeth and cutting up the food preparatory to eating it. As its work of mastication decreased, the lower jaw of the earliest men was already becoming shorter and wider and assuming its horseshoe shape; the crowns of the canines were reduced and the molars, especially the third, became smaller. The size of the processes on the mandible was reduced as was the distance between the condyloid and the coronary processes of the ramus. The chin protuberance developed due to a reduction of the limbic ridge (limbus alveolaris) of the mandible greater than that of its body and also to the development of articulate speech.

Together with the mandible, the maxillary bone and the hard palate changed their shape. The dimensions, thickness and degree of projection of the supra-orbital ridge were also reduced. The various irregularities, bony bars and crests that gave the skulls of our ancestors their external relief, nearly all disappeared. The skull gradually became smoother, but throughout the entire period of human evolution the skull of the male has always had a more strongly expressed relief than that of the female. The general changes in the skull mentioned above, however, are much greater than sex differences. The lesser relief and thinner walls of the cranium provided an opportunity for the brain to develop and the human skull, especially the neurocranium, gradually became wider. Furthermore, the progressive development of the brain led to a reduction of its relief, the skull became higher, the forehead steeper and the skull assumed a rounder form (judging by the considerable length of the cranium of the skulls of the majority of ancient men, man's nearest ancestors most likely possessed the long type of skull, that is, they were dolichocephalic).

The preparation of food and changes in its character were of very great significance to the course taken by anthropogenesis. Our arboreal ancestors were predominantly frugivorous anthropoids like the modern great apes who live on fruits, berries, nuts, young shoots and leaves.

Man's immediate ancestors, such as the Australopithecus, apparently included various small animals in their diet.

Earliest man's tools undoubtedly also served as weapons. It is quite safe to assume that the first men on Earth were already hunters of small and medium-sized animals. Engels considers that flesh used as food facilitated the development of man.

Ancient man is pictured to us as a peculiar sort of "predatory being" whose strength and the sharpness of whose teeth, unlike those of other animals, diminished in the course of natural selection instead of increasing, and were more than made up for by the advantage of artificial instruments. Our ancient gregarious ancestors, the possessors of weapons, had acquired such great possibilities for attack and defence that the reduction in the strength of their jaws and teeth could have had but little significance.

In the course of man's evolution his tools, that is, his artificial organs, underwent greater changes than the natural organs of the body. An animal has limited possibilities of adapting itself to changes in its natural surroundings, but man can perfect himself endlessly by making his work processes and his tools more complicated as the community in which he lives develops. This is one of the greatest features distinguishing man from all other living beings. The use of flesh as food did much to develop the use of fire. Man went over from the consumption of the raw flesh of the animals he killed to the baking and boiling of meat which, of course, made it much more digestible. As a consequence of this his jaws continued to grow smaller and weaker. At the same time changes took place in the abdominal viscera. For example, with the transition from vegetable to animal food or to a mixture of both, the length of the intestines must have changed.

The intestines of modern man are several times longer than his trunk; the length varies in representatives of different races from 740 to 1,000 cm. According to data published by Edward Loth (1931) the shortest intestines in man have a length of 655 cm. and the longest, 1,180 cm. The intestines of a 7-year old chimpanzee that I measured had a length of 828.5 cm. with the length of the trunk at 122.5 cm., i.e., they were 6.76 times longer than the trunk. According to the table compiled by M. A. Magnan (1912) and cited by Loth, the ratio in man varies from 5.0 to 6.3 times.

RATIO OF THE LENGTH OF THE INTESTINES TO THE LENGTH OF THE TRUNK OF MAMMALS OF VARIOUS FOOD HABITS AND OF MAN

(Taken from E. Loth, 1931)

Insectivora	2.5	Omnivorous	6.8
Carnivora	3.7	Frugivorous	7.1
Piscivorous	4.6	Graminivorous	8.7
Man	5.0-6.3	Herbivorous	15.1

This shows that man's intestines are closest in length to those of the omnivorous animals.

The influence brought to bear on the bodies of our ancestors by changes in food habits was no small one. The above-mentioned changes in the human skull are reminiscent of those taking place in certain domestic animals. This latter circumstance, together with the mutability of many physical features in man, for example, the colour of the skin and the physique, provided the basis for Eugen Fischer's theory of domestication (1914).

According to Fischer the points of similarity in the bodily structure of man and the domestic animals may be explained by the fact that the new conditions of life affected man in the same way as they affect domestic animals. Such an explanation is, first of all, one-sided: it ignores the qualitative differences between the formation of man and the evolution of domestic animals, breeds of the latter being developed by the artificial selection of the best individuals, those that are the best producers. Artificial selection played no part at all in the development of man.

The brains of some domestic animals are smaller than those of their wild relatives. The brain of the goat, for example, has been reduced by about one-third. In the hominids, however, the brain grew in size and complexity. Fischer's theory of domestication is unacceptable because it makes the process of anthropogenesis a purely biological one without taking into account its specific nature.

It is typical of man's evolution that the ape characteristics in the structure of his body gradually disappeared and the chief human features, such as biped gait, a stable stance on two feet, the differentiation of the digits of the hand and the highly-evolved cerebral cortex, developed under the influence of working activities; they became still more sharply expressed in the course of the adaptation of man to the social conditions he himself had created and his gradual conquest of nature.

Some of the features of the physical structure of man, for example, the shortening of the facial region of the skull, took place under the influence of a group of factors differing from that influencing similar changes in certain mammals that have been intensively domesticated. Apparently Fischer had in mind the similarity of outward signs, the so-called convergent development.

Engels was of the opinion that the ancestral type of man must have been a species of ape that stood higher than the others in its intellectuality and adaptability. In the life of ancient man the hunting of various mammals must have played an important part in providing the means of subsistence in addition to the gathering of grubs, insects, moths, larvae, bird's and reptile eggs and fledgeling birds.

Beginning with the small, easily obtainable, slow-moving edible animals, ancient man gradually extended his radius of action to the less easily obtainable and often swift small mammals. The capture of

the latter and of birds required the development of special skill in the throwing of stones and sticks. The hunting of medium sized and big animals, however, developed very slowly. It was only by the end of the ice age that man had learned to actually hunt such huge animals as the mammoth. In many cases early man did not disdain to eat the flesh of sick or dead animals.

Their work activity, at first exercised mainly to obtain food, brought about certain new relations between people that were later more clearly expressed as economic or production relations.

Thus the transition to hunting and the use of flesh as food exercised a progressive influence on the formation of man and facilitated the development of certain specific features in the structure of the human body. Orthograde locomotion was perfected, the fixation of the head changed, the jaws were reduced and the capacity of the cranium increased. The entire skull gradually lost its ape features and at the same time became more and more human (Y. Y. Roginsky, 1934).

The human skull acquires a number of progressive features, at the same time losing those that were retrogressive. The same may be said of the development of the brain and the whole human organism. Progressive and retrogressive manifestations are typical of the dialectical course of development not only of man and of all organisms, but of all nature in general.

CHAPTER TWO

THE BRAIN AND HIGHER NERVOUS ACTIVITY IN MAN AND THE APES

1. THE BRAIN AND ANALYSERS OF MAN AND THE APES

The nervous system emerged and developed in the course of the evolution of the animal kingdom and reached its highest level in the vertebrates, especially in the higher mammals, with their complex brains.

The Darwin theory brought great clarity to this question. Engels, writing of the importance of the evolutionary treatment of the structure and activities of the human brain in the light of Darwin's theory, said: "The evolutionary series of organisms from a few simple forms to increasingly multifarious and complicated ones, as it confronts us today, and extending right up to man, has been established as far as its main features are concerned. Thanks to this, not only has it become possible to explain the existing stock of organic products of nature but the basis has also been provided for the prehistory of the human mind, for tracing the various stages of its development, from the simple protoplasm—structureless but sensitive to stimuli—of the lowest organisms right up to the thinking human brain. Without this prehistory, however, the existence of the thinking brain remains a miracle.*

The reflex theory, elaborated by Ivan Pavlov, based partially on Darwinism, is of primary importance to an understanding of the development of the brain and analysers of man and his ancestors in the course of phylogenetic evolution. In connection with this we must mention that the following questions are still of importance to present-day Darwinism: the extent of the influence and effect of the environment on the organism, especially in the early stages of its individual development; the transmission of acquired features by heredity; the mechanism of the emergence of new species as the result of qualitative mutations due to an accumulation of anatomical and physiological changes in

* F. Engels, *Dialectics of Nature*, Moscow 1954, p. 265.

the organism; the presence and extent of the interspecies and intraspecies struggle in the vegetable and animal kingdoms.

As far as the animal kingdom is concerned, special attention must be paid to the development of the nervous system, since it effects a special type of contact with the environment and plays a growingly important part in evolution, in the infinite process of adaptation to constantly changing living conditions. Pavlov's physiological theories, especially that treating of reflexes, give us a new concept of the connections between an organism and its environment.

"The external world that surrounds the animal and, on the one hand, gives rise to endless conditioned reflexes, on the other hand, just as continuously suppresses them, overlays them with other manifestations of life that at any given moment better meet the requirements of the fundamental law of life—the equilibrium of the surroundings," wrote Pavlov, meaning by "equilibrium" the continuous adaptation of an organism to its surroundings. "In this way," he continues, "the cerebral hemispheres constitute both an organ analysing irritations and an organ forming new reflexes, new bonds. They constitute that organ of the animal organism that is specialized for the purpose of constantly effecting a more and more perfect equilibrium of the organism with the environment, an organ for the corresponding, immediate reaction to the most varied combinations and vaviations of the manifestations of the external world and, to a certain degree, a special organ for the continuous further development of the animal organism."

Pavlov established the fact that the central ends of the analysers, connected with the reception of external excitations, are situated in the cerebral hemispheres: the parts of the analysers ending on the periphery at the eyes, ears, skin, nose, mouth, etc., are connected with impulses originating in the skeletal musculature and the internal organs.

The evolutionary development of the analysers in Primates was closely dependent on the transformation of the cerebral cortex, where their central zones are situated, and with the reconstruction of the brain *in toto*. Some information of the general developmental characteristics of the analysers in monkeys under the influence of natural factors will enable us to get a better conception of the distinguishing features of the human brain (fig. 55). It may be safely assumed that truly human traits emerged mainly under the influence of work and speech.

Engels says: "First labour, after it, and then with it, articulate speech —these were the two essential stimuli under the influence of which the brain of the ape gradually changed into that of man, which for all its similarity to the former is far larger and more perfect. Hand in hand with the development of the brain went the development of its most immediate instruments—the sense organs."*

* *Ibid.*, p. 233.

Fig. 55. Simian and human brains:

1—spider monkey (Ateles geoffroyi Hasselt und Kuhl); *2*—baboon (Cynocephalus hamadryas Fr. Cuvier); *3*—agile gibbon (Hylobates agilis Fr. Cuvier); *4*—common chimpanzee (Anthropopithecus troglodytes Flower and Lydekker); *5*—orangutan (Simia satyrus L.); *6*—modern man (Homo sapiens L.). Right lateral aspect. After Th. Mollison, 1932.

The powerful development of man's brain was, in the first place, facilitated by the progressive anatomical and physiological peculiarities of the brain of the extinct apes, his nearest ancestors. At the same time other factors of great importance were—the influence of the new terrestrial way of life, the transition to erect locomotion and a meat diet, the more intense gregarious habits and, lastly, the tool-using habit that began with the use of stones and sticks to obtain food and ward off the attacks of wild beasts. As we have already mentioned, the orthograde position of the body lessened the load on the cervical muscles which had been at a maximum in our most ancient quadruped ancestors when the head was held in a horizontal position. The occipital crest, one of the most important points of attachment for the cervical muscles, ceased to develop and became lower and smoother. The whole external wall of the cranium became smoother, with greatly reduced relief, a factor of extreme importance for the progressive development of the brain and its component parts, in particular for the increase of its dimensions. Here, of course, it is not only a matter of quantitative growth but, what is more important, of the internal transformation and greater intricacy of the brain, down to its finest fibres.

The perfection of erect locomotion, and the growing complication of the functions performed by the hands with the aid of tools, facilitated the progressive development of the brain and the corresponding mutation of the skull. But the final impulse was given at that remarkable turning-point in man's history when our ancestors began making tools, when real work activity was instituted, when new and more powerful developmental factors appeared one after another.

In this way, therefore, erect locomotion facilitated, even if indirectly, the development of the brain of man's forebears, particularly because it freed the fore limbs of the functions of support and locomotion giving them new grasping and striking motions; it brought about a special perfection and refinement of the epidermal sensory organs in the form of papillary lines and patterns on the hands and feet.

Vision became sharper and this enabled pre-man better to find food and observe his enemies: it extended the area over which he could see objects in the world that surrounded him. All this provided the analysers or sensory apparatus with a new structure and functions; this, in turn, brought about a transformation of the cerebral cortex and, to a certain extent, of pre-man's entire organism.

Here we must mention that Pavlov considered the property of extreme plasticity possessed by the nervous system to be of the greatest importance. The Pavlov-Michurin principles of general biology are of special significance in analysing the phylogenic development of the brain and of the peripheral parts of the central nervous system that underwent great changes in man's remote ancestors, the primitive monkeys, and in the still more ancient half-monkeys (including tarsiers) that, in the course of the sixty million years of the Tertiary Period, underwent very great evolutionary changes that gave rise to monkeys, apes and man.

The most varied methods must be applied in the study of the anatomical and physiological peculiarities of the brain. An important place is occupied by macro- and microscopic research, especially of the cerebral cortex, that most important part of the central nervous system.

Principles for the cyto-architectonic investigation of the cerebral cortex of man and animals were established by V. A. Betz, a famous Russian nineteenth-century anatomist who discovered the great pyramidal cells (the motor cells of Betz) in the layer of the cortex now known as the fifth (V) of the six basic layers, counting from the external surface (fig. 56). Betz paved the way for a study of the functions and delicate structures of the brain, thus providing a basis for the division of the cortex from the standpoint of comparative morphology.

The cardinal idea of the interconnection of form and function was further developed by V. A. Bekhterev, L. B. Blumenau and the later progressive cerebrologists.

In the U.S.S.R. today the brain is being studied by biologists, physiologists and other scientific workers on the basis of the Sechenov-Pavlov theories. The work that has been done and is still continuing

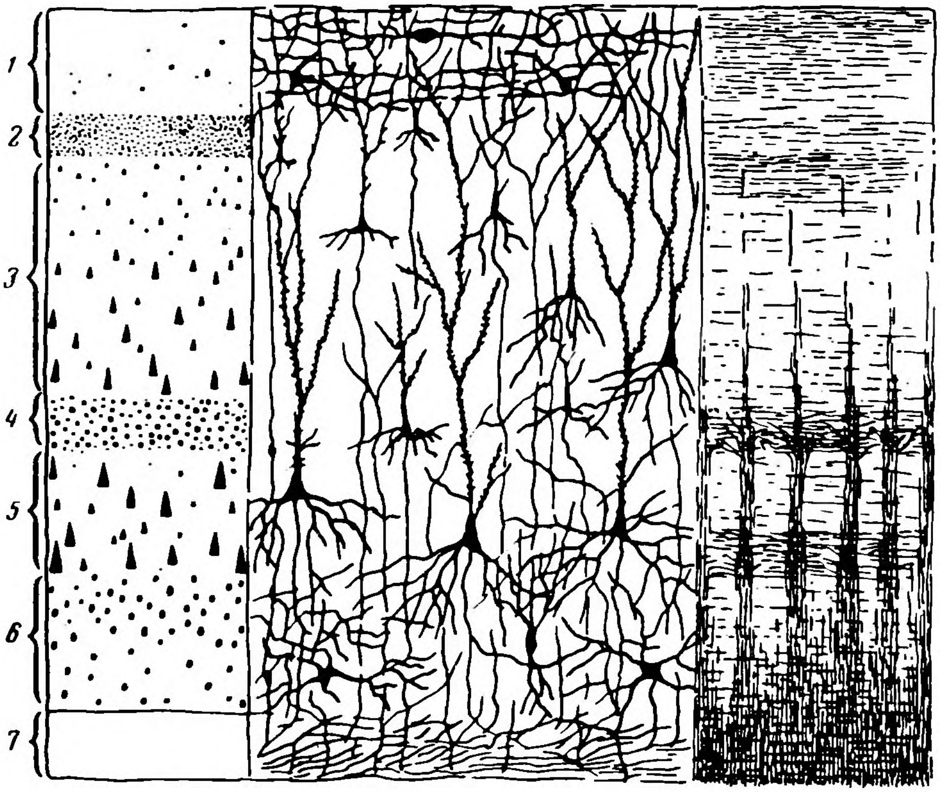


Fig. 56. Stratification of human cerebral cortex:

Strata: *1*—molecular; *2*—outer granular; *3*—small and medium pyramidal cells; *4*—inner granular; *5*—great pyramidal cells of Betz; *6*—polymorphous cells; *7*—white matter. After E. Villiger, 1930.

at the Institute of the Brain and at the Institute of Anthropology of Moscow State University as well as at other research centres, shows that valuable information is obtainable from the study of the cerebral cortices of man, the apes and the monkeys in their historical, evolutionary aspect (T. G. Shevchenko, 1959). In particular, important qualitative differences have been discovered in the star-shaped cells of the third layer of the human cerebral cortex (Polyakov, 1958).

The volume, weight and external relief of the brain are also of great importance to anthropological research. The volume of the human brain varies with the individual from 1,000 c.c. to 2,000 c.c. As far as group variations affecting races or the territorial distribution of anthropological types are concerned, they are between the limits of 1,200 and 1,600 c.c. Brains with a volume of less than 1,000 c.c are rarely met with in man, although cases have been described of individuals, who, irrespective of their race, have been in no way different from their fellows but whose brains, after death, have proved to be 900 c.c., 800 c.c. or even less.

Such great variability distinguishes man from the wild animals in whom variations in the volume and weight of the brain are never more

than about 5-10 per cent. Domestic animals show variations greater than those of wild animals, but they are still not to be compared with those of man; to this must be added that the dimensions of the brain in certain species and breeds have been reduced in captivity.

The volume of the brain and the capacity of the cranium are not equal, there being between the brain and the skull the cranial meninges (dura mater, arachnoid and pia mater), the blood vessels and the cerebrospinal fluid which make the difference in volume quite substantial. In the adult the difference is from 5 to 10 per cent and in old people as much as 15 per cent; in other words, there is a difference of 100 c.c. or even 200 c.c.

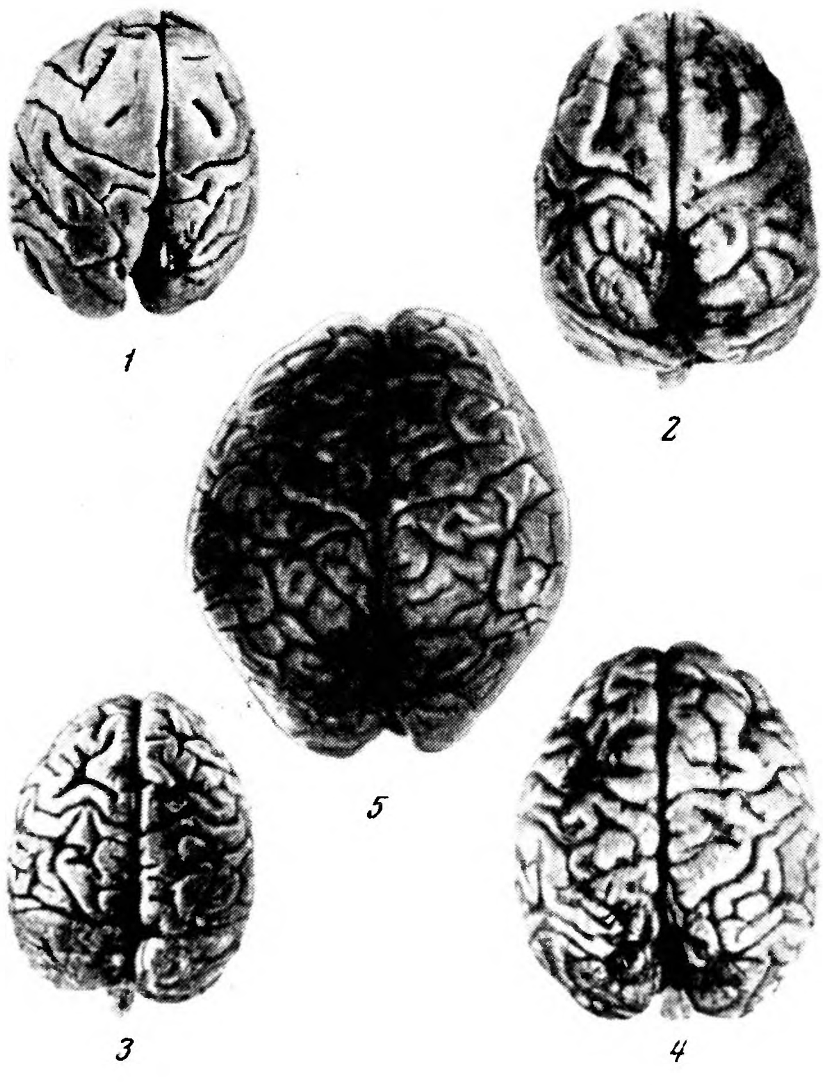


Fig. 57. Primate brains:
1—baboon; 2—gibbon; 3—chimpanzee; 4—gorilla; 5—man. After F. Tilney, 1928.

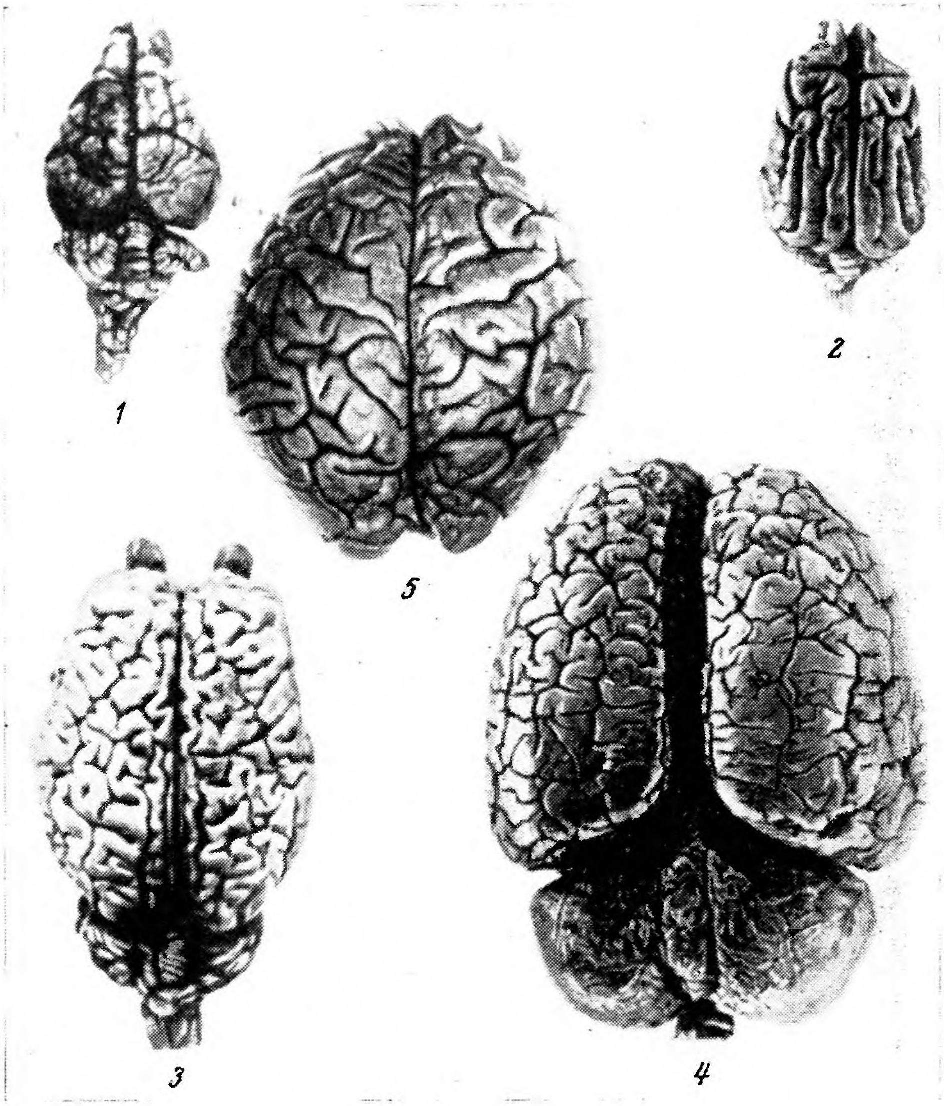


Fig. 58. Human and mammal brains:
1—kangaroo; *2*—dog; *3*—horse; *4*—elephant; *5*—man. After F. Tilney, 1928.

The weight of the brain may be judged by its volume, its specific weight being slightly more than that of water. Most of the mass of the brain is contained in the cerebral hemispheres (87 per cent) and in the cerebellum (11 per cent). Not only the absolute but also the relative weight of the brain place man far in advance of the apes (fig. 57) being ten times that of the gorilla, four times that of the chimpanzee, six times that of the orangutan and twice that of the gibbon.

It is true that the weight of the brain relative to that of the whole body is greater in some New World monkeys than in man, the human ratio being 1:35, that of the capuchin monkey 1:18 and that of the spider monkey 1:15. It must, however, be borne in mind that the smaller the mammal

the greater the relative weight of its brain. In view of this specific regularity the ratios for man and the apes given above will be easily understood.

Furthermore, although the brain of such a huge animal as the Indian elephant weighs four times as much as that of man (fig. 58), its relative weight (1:560) is almost fifteen times less.

The absolute and relative weights of man's brain give him such a prominent place in the animal kingdom that this alone is sufficient to place him far above any of the animals named.

The specific features of the human brain may be observed during its ontogenetic development (B. N. Klosovsky, 1954) which, on the other hand, clearly demonstrates man's close relationship to the higher apes. The inception of cortical development takes place in the central part of the hemispheres and proceeds radially over the surface to the peripheries; it differentiates into layers of which there are as many as six. Then comes a great change in the further development of the cortex in the foetus—namely, the appearance of regions, areas and subareas together with their convolutions (gyri) and fissures (fissurae) and furrows (sulci) in the cortex.

The inception of the fissures and convolutions, says G. I. Polyakov (1937, 1949), follows after profound cyto-architectonic changes in the neocortex that constitutes up to 95 per cent of the total volume of the human cortex.

At the beginning of the fourth lunar month of the uterine period of development the first basirhinal or olfactory fissure appears. After this the sylvian fossa begins to form and some fissures and furrows emerge on the temporal, frontal and parietal parts of the lateral sides of the cerebral hemispheres in the vicinity of this lateral fossa (fig. 59).

After the sylvian fossa, in both man and the anthropoids, the central sulcus (Rolando) appears; in the lower monkeys the formation of the sylvian fossa is followed by that of the parallel sulcus which corresponds to the superior temporal sulcus in man. In the fifth lunar month several

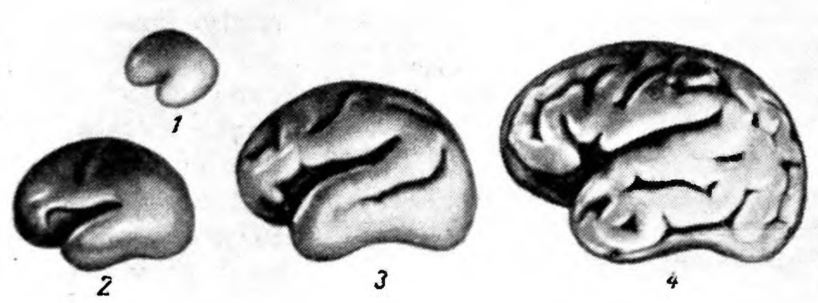


Fig. 59. Development of human brain:
1—foetus at 3 months; *2*—foetus at 5 months; *3*—foetus at 7 months; *4*—newborn. Left lateral aspect. From casts at Moscow Museum of Anthropology.

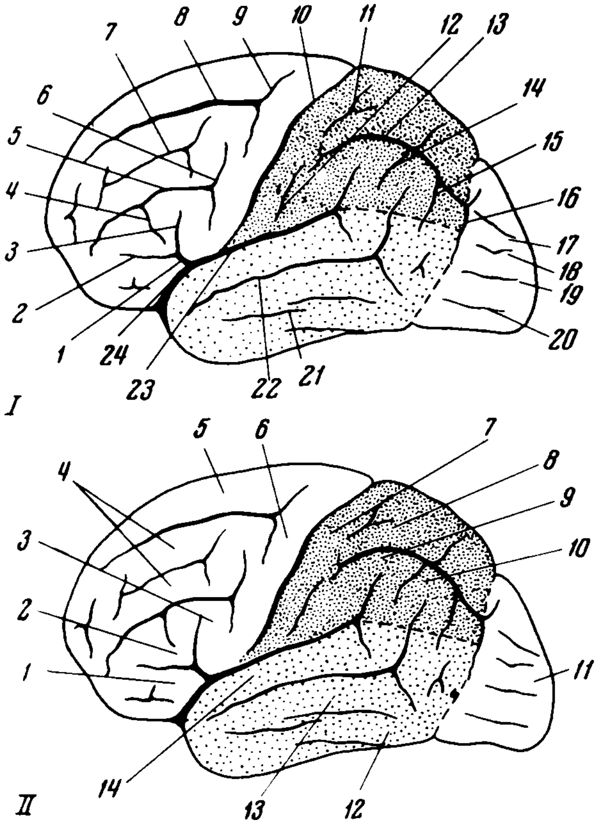


Fig. 60. Lateral surface of human cerebral hemisphere:

I—furrows (sulci) and *II*—convolutions (gyri). Left unshaded area—frontal lobe; densely shaded area—parietal, dotted—temporal and right unshaded—occipital lobe. *1* and *2*—anterior horizontal branch at the beginning of the sylvian fissure; *3*—anterior ascending branch of *1* and *2*; between lines to *3* and *4*—frontal pole; *4*—radial sulcus; *5*—inferior frontal sulcus; *6*—inferior precentral sulcus; *7*—medial frontal sulcus; *8*—superior frontal sulcus; *9*—superior precentral sulcus; *10*—central sulcus (of Roland); *11* and *12*—postcentral sulcus; *13*—interparietal sulcus; *14*—first intermediate sulcus from *13* (on other side of *13* is point of departure of parietal sulcus), between *14* and *13*, at edge, between parietal and occipital lobes, parietal-occipital fissure can be seen; *15*—second intermediate sulcus; *16*—transverse occipital sulcus; *17, 18, 19, 20*—superior and lateral occipital sulci; inferiorly from *20*—occipital pole; between occipital and parietal lobes the preoccipital incision and on temporal lobe the inferior temporal sulcus are visible; *21*—medial temporal sulcus; *22*—superior temporal sulcus (its anterior end, extending anteriorly to left, joins temporal pole); *23*—posterior branch of sylvian fissure; *24*—stem of sylvian fissure. *II*. *1*—inferior frontal gyrus, orbital part; *2*—idem, triangular part; *3*—idem, opercular part; *4*—medial frontal; *5*—superior frontal; *6*—anterior central; *7*—posterior central; *8*—superior parietal; *9*—superior marginal gyrus of inferior part of parietal lobe; *10*—idem, angular gyrus; *11*—descending gyrus of occipital lobe; *12*—inferior temporal; *13*—medial temporal; *14*—superior temporal gyrus. After E. Villiger, 1930.

other sulci are noticeable on the cerebral hemispheres of the human foetus. In the following month the edges of the sylvian fossa begin to close and the central lobe of the brain gradually sinks to the bottom of the fossa. In the course of uterine development a pattern of fissures and sulci is gradually formed on the cortex of the hemispheres that is typical of those animals that are gyrencephalic, i.e., whose brains are more or less covered with convolutions as distinct from the lissencephalic, those whose brains have a smooth surface.

Not only these but many other specific features of the ontogenetic development of the brain of the human foetus bear witness to the stages of phylogenetic development through which our ancestors have passed, beginning from the lowest type of Chordata.

At the time of parturition the brain of the foetus already possesses the sulci and gyri disposed and developed in such a way that it might serve as the prototype of the adult brain: it still has before it almost twenty years of development by way of increasing its dimensions and complicating its surface pattern by the appearance of additional furrows of the second and

third order (figs. 60-62). The young of Placentalia are born with a sufficiently formed brain which ceases to grow soon after birth. The ontogenetic development of the animal brain ceases, on the whole, at an early age so that man in this respect, too, constitutes an exception. This can be seen even by comparing the brains of man and the apes, both by weight and by volume; the human child's brain is only about a quarter of that of the adult while that of the young ape is about a half or even two-thirds of that of the adult.

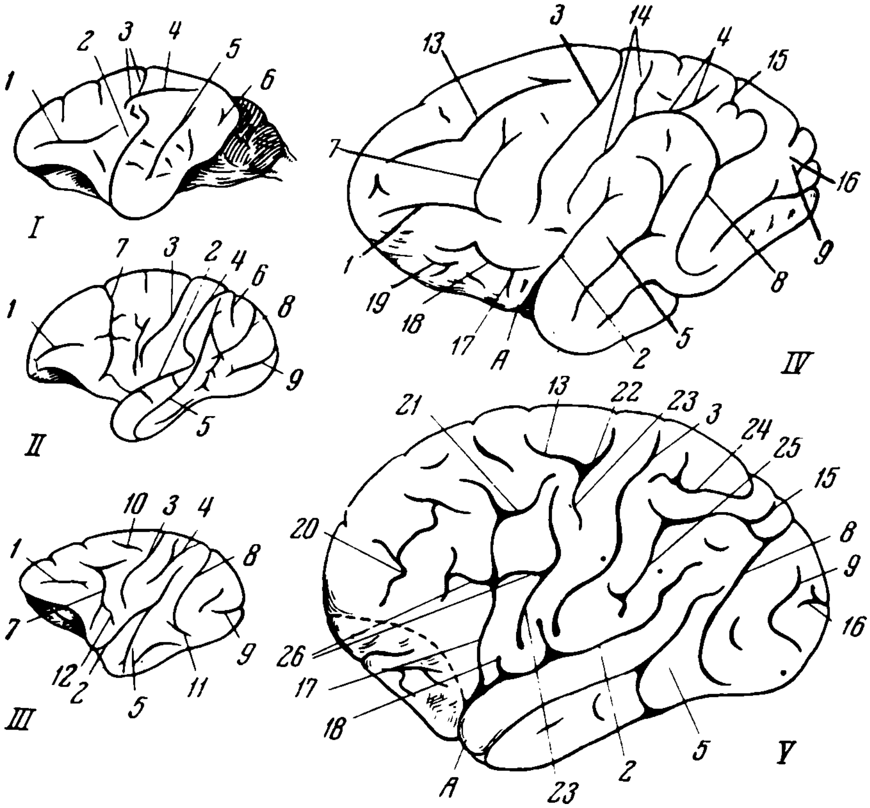


Fig. 61. Disposition of the sulci on cerebral hemispheres of Primates:
I—black lemur (Lemur macaco L.); *II*—brown marmoset (Cebus fatuellus L.); *III*—pig-tailed macaque (Macacus nemestrinus L.); *IV*—Hoolock gibbon (Hylobates hoolock Harlan); *V*—common chimpanzee (Anthropopithecus troglodytes Blumenbach). *A*—exterior region of central lobe; *1*—sulcus rectus; *2*—sylvian fissure; *3*—central sulcus; *4*—inter-or intraparietal; *5*—parallel; *6*—transverse occipital; *7*—inferior precentral or arched; *8*—simian; *9*—lateral occipital; *10*—superior precentral; *11*—inferior occipital; *12*—inferior transverse; *13*—superior frontal; *14*—postcentral; *15*—parieto-occipital; *16*—calcarine fissure; *17*—fronto-orbital sulcus; *18*—superior boundary; *19*—orbital; *20*—fronto-marginal Wernicke; *21*—medial frontal; *22*—superior precentral; *23*—inferior precentral; *24*—supplementary and intraparietal; *25*—inferior postcentral; *26*—inferior frontal sulcus. After Ch. Sonntag, 1924.

The brain of a great ape, such as the orangutan, acquires considerable weight during the first two or three years of the animal's life but later there is little growth. The changes that take place in the weight of the human brain at different ages were studied by V. V. Bunak (1936). Using a complicated method and special computations he arrived at the conclusion that former conceptions of the greatest cerebralization

in the infant were incorrect and that the relative mass of the brain reaches the maximum at the age of 3 to 5 years after which the ratio gradually and to a very small extent undergoes reduction owing to the more intensive growth of the mass of the body.

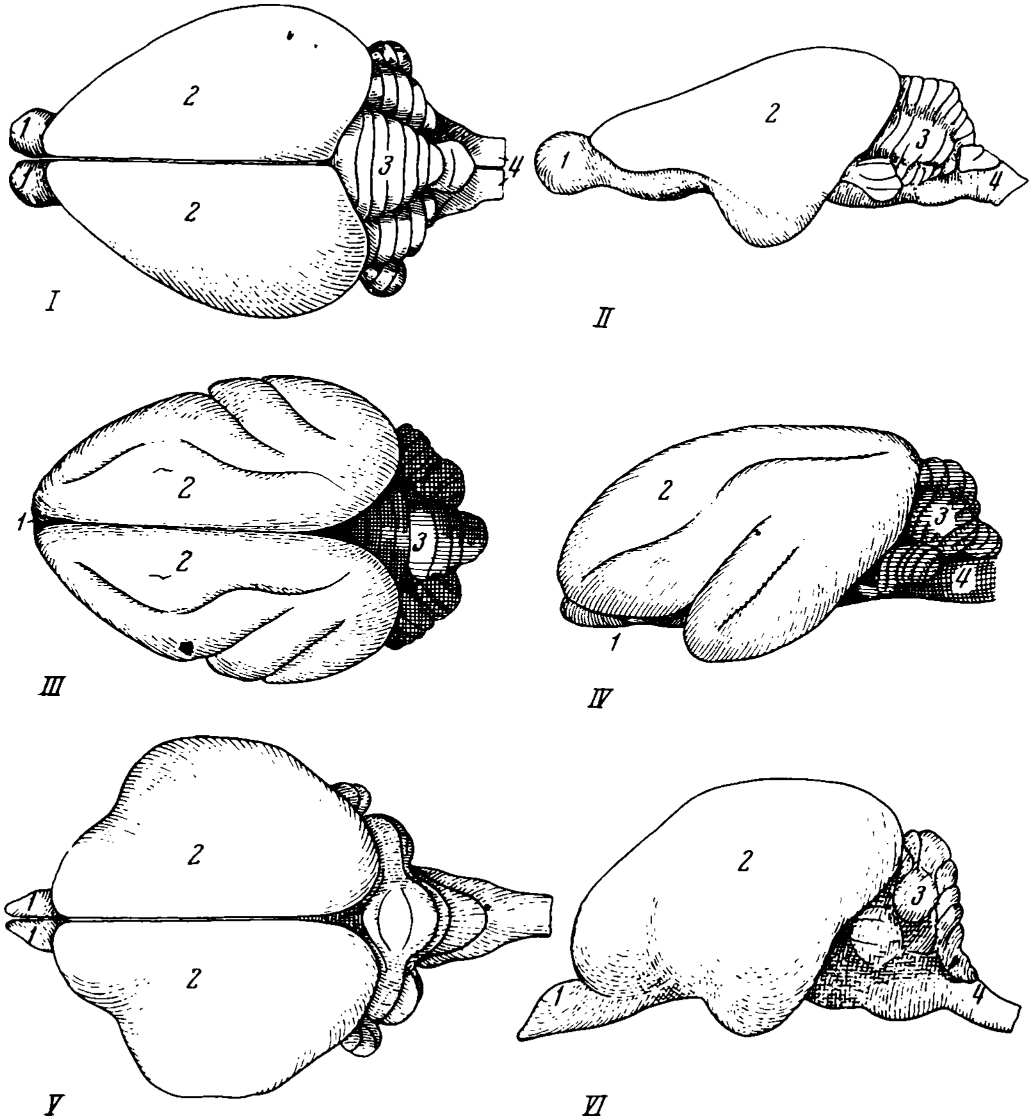


Fig. 62. Brains of lower Primates:
I, II—Günther's tree-shrew or lesser tupaia (Tupaia minor Günther); *III, IV*—black lemur (Lemur macaco L.); *V, VI*—spectral tarsier (Tarsius spectrum Storr). *1*—olfactory areas; *2*—frontal lobes; *3*—cerebellum; *4*—medulla oblongata. After F. Wood Jones, 1929.

In the course of further growth the sex differences in the weight of the brain become more pronounced: the average for an adult male is 1,400 gr. and for an adult female, 1,270 gr., i.e., 130 gr. less. If we take into consideration the fact that the human brain varies within

the limits of several hundred cubic centimetres and that the level of intellectual development does not depend on the absolute weight of the brain, then no importance can be attached to this difference.

To this must be added that the relative weight of the female brain is usually somewhat greater than that of the male brain since the man, on the average, is 8-9 kg. heavier than the woman, the average height of a man being about ten centimetres greater than the woman's average. The same is true of such anthropoid apes as the gorilla and the orang-utan; the males are much heavier than the females and the relative weight of the brain is greater in the female than in the male.

Among the specific features of the human brain is also the noticeable asymmetry in the shape and structure of the hemispheres. Right-handed people have a left cerebral hemisphere that is more highly developed than the right, with the motor speech area located on the former. The brain of an anthropoid is not so asymmetric as that of man although cases of the preferential development of the left hemisphere have been noted; the left hemisphere of the young male orangutan Moritz at the Moscow Zoological Gardens proved somewhat longer than the right (the animal died in 1933).

Facts that have been established by the study of the dimensions of the cranial vault of man and the apes enable us to draw the conclusion that man is not the only possessor of an asymmetric brain. Apparently this feature was present in a less developed form in the fossil pre-men of the Tertiary Period such as the Australopithecus. It is possible that the greater asymmetry of the human brain developed correlatively with the perfection of erect locomotion, the liberation of the hands and the preferential use of the right hand in the work activities of the hominids.

2. DEVELOPMENT OF THE PERIPHERAL REGIONS OF THE ANALYSERS

It may safely be assumed that the immediate ancestors of the Primates were the small terrestrial insectivorous mammals that lived at the end of the Cretaceous Period of the Mesozoic Era, more than sixty million years ago. These animals had a strongly developed olfactory organ as can be judged from their long snouts and the abundance of nasal conchae and also by what were probably huge olfactory brain lobes: in other words, the peripheral and central regions of the olfactory analyser were well formed and functioned excellently.

The olfactory analyser of the apes is poorly developed and its peripheral part, the nose, is seldom strongly expressed; in man a weak olfactory sense is combined with a big nose that has a strong bone and cartilage framework.

The development of the exterior part of the human nose, a specific formation in both shape and structure, depends to a considerable

extent on the upward development of the superior parts of the maxillae, the vertical plate (lamina perpendicularis) of the ethmoid bone and the vomer combined with the recession of the alveolar process (limbus alveolaris) of the maxilla. This feature is not found in monkeys, even in the anthropoids. The nose of the gorilla or gibbon, with its strong cartilaginous skeleton, most nearly approximates that of man.

According to Weber (1936) the nasal skeleton of the ape consists of the same bones and cartilages as that of man; the absence of an externally projecting nose is due to the strong development of the ape's upper jaw, the narrowness of the nasal foramen, the shape of the nasal cartilages and the small size and slight projection of the nasal bones.

The above description applies also to the proboscis monkey of Borneo, an animal belonging to the sub-family of Semnopithecinae. Its long, soft, mobile nose is more in the nature of a trunk. There is a long, deep, longitudinal furrow at the end and it can be distended at times of rage or sexual excitement. In elderly individuals the nose hangs down below the chin.

There are several other langurs (Semnopithecus) that have noses: for example, the douc langur (Pigathrix nemaeus Linnaeus) living in the island of Hainan and upper Cochinchina; the short-tailed langur (Simias concolor Miller) from the southern island of Pageh, near Sumatra, also has a clearly expressed nose. There is the genus of Nosed Apes of which the species are the snub-nosed golden monkey (Rhinopithecus roxellanae Milne-Edwards) of North-West China, the Bietian snub-nosed monkey (Rh. bieti Milne-Edwards) of Yunnan, West China and South-East Tibet, the Brelichian snub-nosed monkey (Rh. brelichi Thomas) of Central China and South-East Tibet and the Tongking snub-nosed monkey, or "uncle ape" (Rh. avunculus Dollman-Presbytiscus avunculus Pocock) of Tongking, North Viet-Nam.

There are very many monkeys whose external organ of smell is quite small; this is particularly true of such anthropoid apes as the orangutan and chimpanzee. The skulls of these two apes are somewhat concave in the region of the nasal orifice, i.e., they are symognathous.

The median-longitudinal gristly frame of the human nose consists of the inferior part of the septum, the cartilages of the nasal walls (on either side between the nasal bone and the main cartilages of the alae or wings) and a number of smaller ones.

Within the nasal orifice and on its side walls are three nasal conchae, the inferior, middle and superior. A newborn infant has a fourth—Santorini's concha—which in 50-57 per cent of all cases later disappears.

The presence of a fifth concha in man is very rare. Cases of the retention of a fourth or fifth concha in the adult is evidence that man's distant ancestors had a more actively functioning olfactory organ. In modern man only the superior nasal concha belongs to the olfactory region. The reduction of the number of nasal conchae in man puts him in the group of microsmatic Primates together with the apes,

monkeys and the tarsiers as distinct from the lemurs and tupaias, who are macrosmatic, having a more strongly developed sense of smell. The fine distinction of odours as a means of distinguishing objects is intimately connected with the ability to form conditioned reflexes, strongly expressed in birds and still more strongly in mammals.

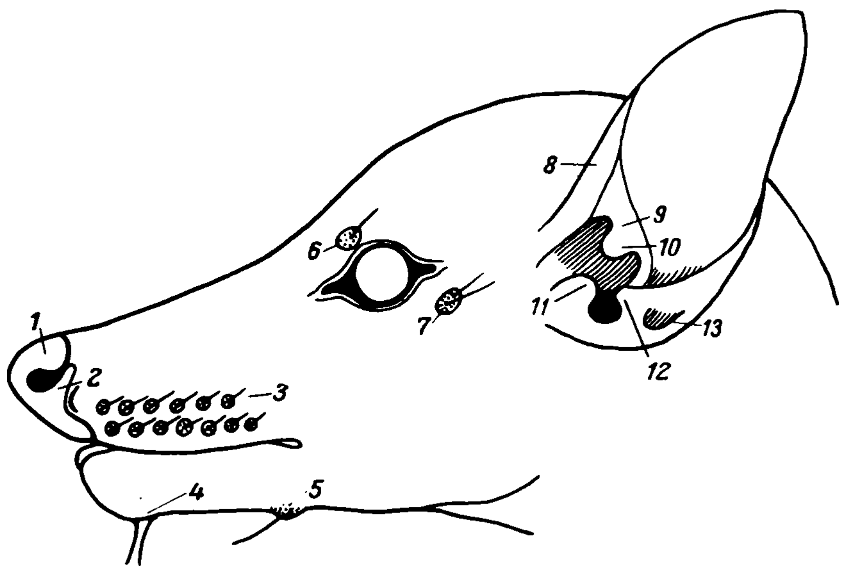


Fig. 63. Bunches of vibrissae and ear of Madagascar lemur (Chirogale E. Geoffroy), diagram:

1—medial nasal eminence; *2*—lateral nasal eminence; *3*—vibrissae on upper jaw (vv. mysticiales); *4*—chin vibrissae (vv. submentales); *5*—vibrissae between the ramae of the mandible (vv. interramales); *6*—supra-orbital vibrissae; *7*—vibrissae genales; *8*—the helix; *9*—the antihelix; *10*—the antihelical process; *11*—the tragus; *12*—the antitragus; *13*—fossa (bursa). After F. Wood Jones, 1929.

Parallel to the retrogression of the olfactory analyser man and the monkeys also experienced a reduction of special sensory organs of the face: both these processes were interconnected and were closely linked up with the shortening of the facial region, especially the nasal area. Of the lower Primates, the half-monkeys have up to four paired and one unpaired bunches of long, stiff bristles, known as vibrissae, on the face; these are specialized tactile hairs (figs. 63-64). At the base of these hairs in the epidermis there are special nerve ends and minute accumulations of blood in the form of sinuses. The slightest contact between a vibrissa and any object immediately causes a disturbance of the blood sinus and a signal is transmitted by the nerve that produces a concept of the surface of object.

Only three paired bunches of vibrissae have remained on the faces of the lower monkeys—in the supra-orbital area, on the upper lip and the chin. The anthropoid apes have only two bunches (Duckworth, 1915) and man has none. Even in the embryonic period of man's development such hairs with blood sinuses are rarely found on the face of the foetus.

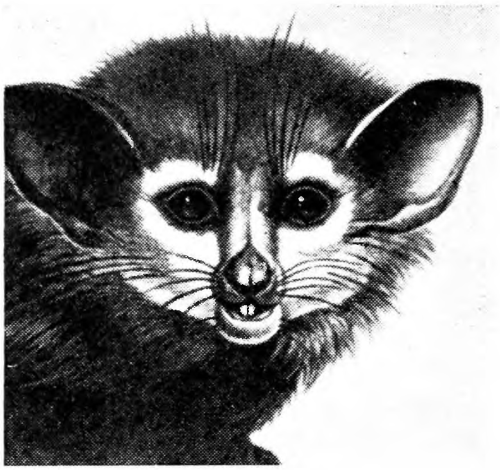


Fig. 64. The Chiromys madagascariensis E. Geoffroy; bunches of vibrissae are clearly visible on face.
After G. Grandidier and G. Petit, 1932.

Retrogressive as well as progressive changes took place in the sensory organs as a result of arboreal life. For example, in place of the separate pads common to the feet of many of the lower mammals, the plantar, palmar and volar skin in monkeys is covered with papillary ridges in combination with flexure creases (fig. 65).

These papillary ridges are furnished with bunches of nerve ends that enable the hand or foot to receive the sum of sensory excitations and to react to contact with branches, fruits and other objects in the surrounding world. The papillary ridges and their junctions form specific triradial patterns on the palms of the hands and soles of the feet and rings, whorls and deltas on the terminal phalanges of the digits. The direction of the flexure creases, transverse or longitudinal, depends on the manner of folding the hand or foot of each species of monkey and of each individual.

The dermatoglyphic pattern of ridges and creases on the hand of any man is very intricate and is never repeated. This pattern is man's dactyloscopic and, at the same time, his anthropological signature; the study of these patterns has proved of great interest both to anthropology and to forensic medicine. The latter science developed a special branch, dactyloscopy, or finger-print reading, that has often made it possible to establish the identity of a criminal by finger-prints left on the scene of a crime.

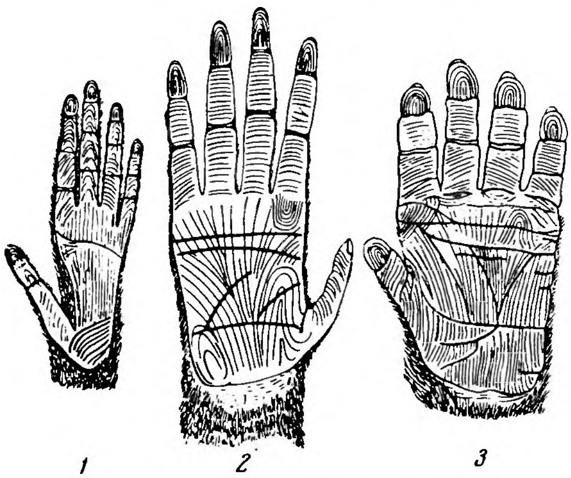


Fig. 65. Flexor and papillary ridges on palmar surface of anthropoid hands:
1—gibbon; 2—orangutan; 3—gorilla. After Ch. Sonntag, 1924.

To the biologist the pattern of the papillary ridges is important because it is the result of phylogenic development; it indicates the course taken by species development, the manner in which the Primates adapted themselves to arboreal life. In man, it indicates the way in which the

organism has been transformed by work activities. The changes that took place in the patterns as a result of increased receptiveness characterize the special path taken by the evolution of man's sensory system as compared with that of the apes.

It must be stressed that the delicate sense of touch possessed by the hands of man's ancestors, the extinct apes, must undoubtedly have been one of the most important prerequisites for the correct use and fabrication of tools. The reverse is also true: hundreds of diverse forms of work for many thousands of years have further perfected the human hand. It developed as a qualitatively specific organ whose activities are closely connected with the kinaesthetic, epidermal, visual and other analysers. The dimensions, shape and weight of a stone tool or of other objects began to be judged in a new way as compared with the tactile perception that had developed during the evolution of man's ape-like ancestors who had been accustomed to handling branches, fruits, etc., in the trees.

The tactile analysers developed under the influence of the external world no less than the olfactory analysers, because in climbing trees by grasping these apes not only developed prehensile feet furnished with nails but also prehensile hands with nails. This, however, was connected with the powerful development of sensory nerve papillae in the palmar and plantar skin of the hands and feet. The entire mutation of the extremities provided the necessary co-ordination and stability of movement during the complicated and at times highly risky process of arboreal locomotion.

The maintenance of equilibrium when tree climbing and leaping from branch to branch is a priority problem for the monkeys that could only have been solved by the specific development of the organs of balance, chiefly the vestibule apparatus of the inner ear and the cerebellum. The movements of the hands and feet are co-ordinated by these organs.

The participation of the extremities in locomotion was very closely connected with the visual analyser that had undergone considerable progressive development. The shortening of the muzzle in ancient types of primate such as the half-monkeys enabled the external region of the visual analyser to undergo considerable reconstruction. The fields of vision that had been separate when the eyes were placed at the sides of the head began to cover each other when the eyes moved to the anterior part of the head (fig. 66). In other words there was a progressive development of binocular or stereoscopic vision in the Primates that enabled them to see objects in relief: it also gave them the ability more clearly to distinguish the colours of their habitat, the tropical forest, thus evolving colour vision.

The changes in the analysers—olfactory, tactile and visual—were due to a complex of factors and influences from the external world, one of which was doubtlessly the change in food habits. Instead of searching

for insects and their larvae in a terrestrial world of the most diverse smells in the manner of the modern insect-eating mammals, the most ancient Primates, themselves probably closely resembling the Insectivora, of a type similar to the modern tupaias (M. Weber, 1936), began to

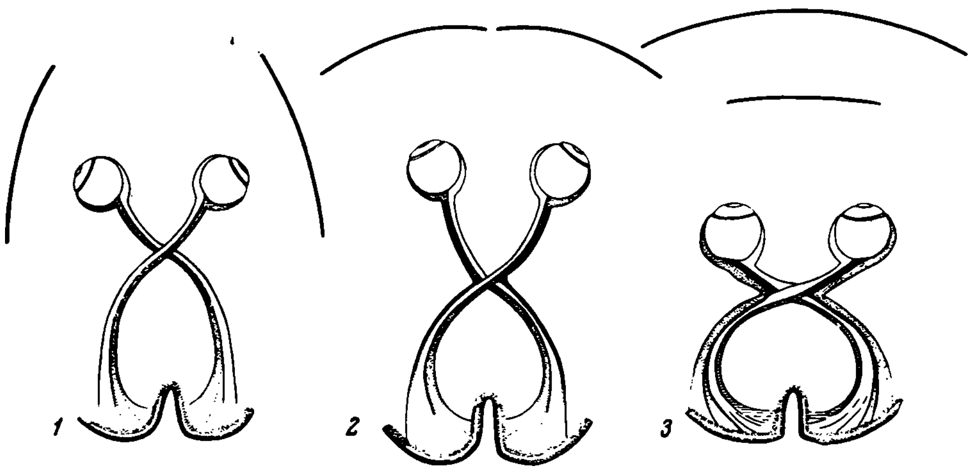


Fig. 66. Diagram of decussation of optic nerves in various mammals:
1—with independent movement of eyes and separate (monocular) fields of vision (horse, etc.)—complete decussation of optic nerves; 2—with correlated movement of eyes and combined monocular fields of vision (hare, etc.)—almost complete decussation; 3—fully correlated movements of eyes and reactions of pupils, with a clear binocular field of vision and a bimacular field of visual fixation (full decussation of retinal and macular fibres of optic nerve, i.e., fibres from right half of retina lead to right cerebral hemisphere and from left half to left). After F. Wood Jones and O. Porteus, 1929.

make more frequent use of vegetable food in the form of berries, nuts, fruits, buds, leaves, flowers and the sap of plants. The outward appearance of all kinds of vegetable food must have had great significance, even if only because the ancient half-monkey must have established some sort of connection between the colouring of a fruit and its degree of edibility and this was a matter of vital importance to them.

The modern monkeys, at least in comparison with their distant ancestors, the fossil half-monkeys, have a strongly developed visual analyser. The orbits of the monkey are placed anteriorly and in the depth of the retina there is even a "yellow spot" (macula lutea) with its depression, the point of clearest vision: monkeys have high visual acuity and see the objects of the external world in relief and colour.

Visual acuity in monkeys is superior to that of other mammals because they can see objects in three dimensions, that is, they have stereoscopic vision. The eyes of our nearest relatives, the apes and monkeys, are directed forward while those of the majority of other mammals are directed sideways at a greater or lesser angle; the eyes of the lemurs and tarsiers are placed at 45° to the anterior position while those of the tupaias are even farther to the side. In the course of evolution the eyes of the ancestors of modern monkeys moved from the lateral to the anterior position so that they can see objects in front of them in full relief.

The development of three-dimensional vision in man was conditioned by the evolution of his Tertiary monkey-like ancestors. This feature is typical of the evolution of man and the monkeys. Our more distant ancestors, like the modern lower mammals, had completely crossed (decussated) visual nerves: the right visual nerve was attached to the left and the left visual nerve to the right eye. The monkeys and man have organs of vision with semi-decussation, i.e., half of the left visual nerve fibres are attached to half of the left eye, the other half being attached to the right eye and vice versa.

As we have already mentioned, on the retina of the eyes of man and the monkeys, there is a yellow spot with a central depression (macula lutea) at the point of entry of the optic nerve: this is the point of clearest vision. The combined reception of visual impressions simultaneously by two eyes, both placed anteriorly in the head, and the consequent formation of a single field of vision, provides an accurate picture of the object viewed. The macula lutea is not found in any other mammals. In man it has a simpler structure than that of the monkeys as the nerve endings of the former consist of a small number of cones while the latter have rods in addition. Both kinds of nerve ending in the monkeys are, moreover, finer and more numerous.

Man, therefore, owes his binocular vision primarily to his ape ancestors. To them, also, he owes his ability to see the world of colour. Man, with his three-colour vision, approximates the Old World monkeys. The chimpanzee can easily distinguish blue and green colours but its perception of the reds and yellows is poorer than that of man and more like the vision of the guenous. The capuchin monkeys, by the way, do not see the red colours at all and resemble a man suffering from protanopia, or red blindness.

High visual acuity that was at the same time binocular and able to distinguish colours was biologically extremely advantageous to the monkeys in their tropical jungle habitat where wild beasts, poisonous snakes and numerous parasites and thorns abound. When they feel that they are out of danger and are not engaged in eating, when they are resting after a journey through the scrub, they busy themselves picking insects and thorns out of each other's fur. Usually one monkey lies down or stands in a convenient posture and remains outwardly passive while the other searches its fur and the open patches of skin. The seeker carefully picks over the hair, one wisp after another, and from time to time seizes an insect or other extraneous object with its fingers and nails.

Insects are very tiny and irritating; ridding the body of them brings great relief to animals and people living in the tropics. To realize this one has but to recall descriptions of long and frequently tormenting journeys in Africa where one of the main obstacles to travel was the myriads of biting and stinging insects, ants among them. It is no easy matter to see and capture a tiny insect that can escape by swift running

or agile leaping. This requires great visual acuity, swift and well co-ordinated movements and well organized cerebral connection between the motor sections of the cortex regulating the functioning of the hands and the optic region.

Here we must mention that the term "hunting for fleas" does not really describe the action of the monkeys in searching each other's coats. It may be safely assumed that an important part is played by "grooming," the removal of weak or fallen hairs, from which the monkey immediately eats the bulb and the root together with the tiny crystals that form part of the matter in the sweat glands (Ewing, 1935).

Binocular vision in man's ancestors progressed simultaneously with the development of the more delicate grasping motions of the fore extremities and with the greater opposability of the thumb to the other digits. To manipulate various edible objects, carry them to the eyes and examine them from all angles, to bite off parts of a fruit and examine the part bitten, to capture and examine tiny parasites—all these and similar actions performed by the Tertiary apes, must have facilitated, in the course of natural selection, the combined progressive development of the motor analysers and the fore limbs, as well as the combination of movements under the control of the eye. Work performed by the earliest men must have brought changes to this process and accelerated it during the first hundreds of thousands of years of the Quaternary Period; this can, to some extent, be traced in casts made from endocrans. Tool-making is inconceivable without the special development of prehensile fore extremities, the hands, or without acute binocular vision. It was precisely this combination of anatomico-physiological peculiarities that our ancestors possessed.

For the emergence of man and for his entire further evolution, therefore, there had to be a constant progressive development of the general structure of the nerves and muscles of the hand and of the delicate architectonics of the corresponding parts of the central nervous system and the organ of vision. The hand and the brain, mutually affecting each other, developed in the course of socially performed work.

The tactile and visual analysers in combination with the motor analysers of the early Primates must have developed in a way that was new as compared with their small terrestrial ancestors and enabled them not only to change their method of locomotion and food habits, but to adapt themselves to the conditions of interspecies struggle, particularly against such dangerous animals as the great cats, various kinds of snakes and birds of prey.

The aural analyser also played an important part by its specialization in distinguishing the various jungle sounds. Auditory acuity is of great importance to the monkey both by day and by night: it sometimes saves them from nocturnal beasts of prey that creep up close to them. Monkeys listen constantly to the sounds made by the voices of other members of the herd. Some of the sounds emitted by monkeys have the signif-

icance of signals and it does not matter which of the monkeys emits the sound that warns the herd of danger.

Nina A. Tikh, a scientist who worked at the Sukhumi Medico-Biological Station of the Academy of Medical Sciences, did some important research into the means of communication employed by monkeys in a herd (1950). Her research was carried out on a herd of hamadryas baboons whose voices appear to produce about fifteen different sounds expressing the emotional state of the ape. She established the fact that the sounds emitted by the baboons are closely connected with the emotional basis and with correlated movements of the body. It proved to be very difficult to evoke them artificially, even by the method of conditioning reflexes, partially because of the stereotyped nature of the sound expression of emotions and the strong connection of congenital (unconditioned) sounds with a definite biological weight. For example, it is more difficult to evoke a sound of defensive significance by food signals than to evoke a sound indicating food. In experiments made by M. A. Pankratov a derangement in the higher nervous activity of apes was additionally noted (L. G. Voronin, 1952).

To this must be added that the peripheral and cortical regions of the aural analyser in monkeys and anthropoid apes are often more highly differentiated than those of man. Monkeys, for example, can hear extremely high tones (with a frequency of about 30,000 cycles a second) that man cannot detect without the aid of special acoustic appliances. Monkeys have highly developed auricular muscles and can move their ears freely, while the external ear of man, despite its greater size, is as incapable (or almost incapable) of motion as those of the gorilla and orang-utan who have much smaller helices.

In the same way the monkeys have more highly developed analysers in other fields, for example, the visual and, especially, the olfactory analysers. In other words, the monkeys have a number of advantages in the sphere of the first system of signals. But man is incomparably superior to his monkey relatives in the functioning of his brain and in his use of the second system of signals (speech) and its analysers which enable him to recognize aspects of objects inaccessible to any animal.

The peripheral regions of the auricular, tactile, visual and other analysers were directly connected with the corresponding cortical regions of the cerebral hemispheres and developed together with them in the course of the evolution of the Primates under the influence of the environment. Now let us examine the corresponding areas of the cerebral cortex.

The monkey type of brain developed from that of a more primitive Primate, such as a half-monkey. The lemur, for example, has a very small brain that weighs only a few dozen grams; its olfactory region is well developed but the frontal lobes are small; the temporal lobe, typical of all Primates in general, is clearly expressed; the surface of the cerebral hemispheres of most Primates has a small number of gyri or convolutions; in the occipital region there is a noticeable spur-like fissure (fissura

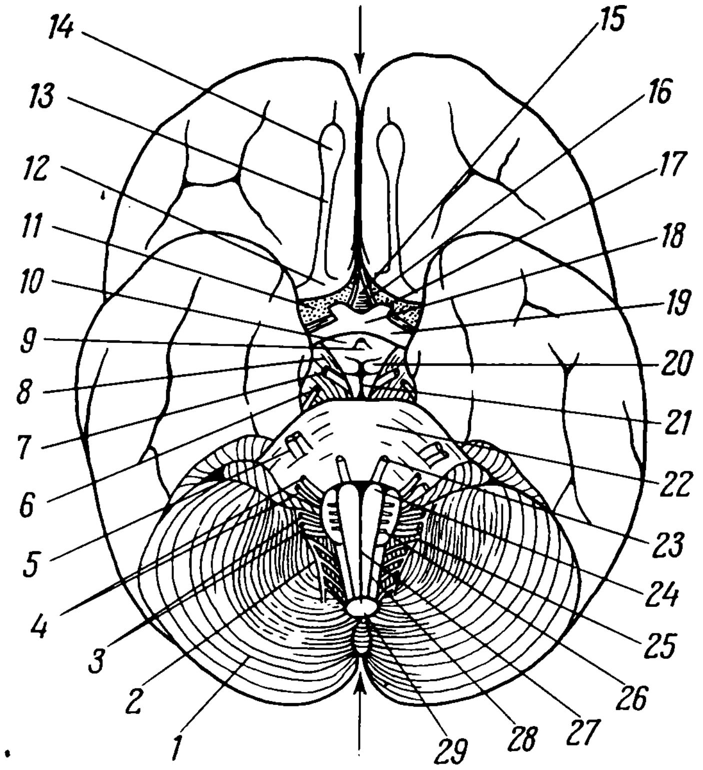


Fig. 67. Base view of human brain:
1—cerebellum; *2*—accessory nerve; *3*—glossopharyngeal and vagus nerves; *4*—facial and acoustic nerves; *5*—triangular nerve; *6*—trochlear nerve; *7*—oculomotor nerve; *8*—cerebral peduncles; *9*—infundibulum; *10*—tuber cinereum; *11*—grey anterior perforate field; *12*—olfactory triangle; *13*—olfactory tract; *14*—olfactory bulb (the arrow between *14* and *15* points to longitudinal fissure); *15*—lamina terminalis; *16*—diagonal ligament; *17*—optic nerve; *18*—optic decussation; *19*—optic tract; *20*—mamillary body (corpora candicantia); *21*—interpeduncular fossa (Tarini); posterior perforate field lies in this fossa; *22*—pons and main sulcus of pons; *23*—abducens nerve; *24*—pyramid of the medulla; *25*—olive; *26*—hypoglossal nerve; *27*—medial anterior fissure of medulla; *28*—anterior lateral nerve; *29*—medulla oblongata (arrow between *29* and *1* points to resection of cerebellum). After E. Villiger, 1930.

calcarina) such as is found in all other Primates; the cerebellum is only partially overlapped by the brain.

In the brain stem of all Primates, including man, there are signs of segmentation. This is more clearly expressed in the spinal cord, where it is observed in the paired, equidistant branching of bunches of spinal sensory and abdominal motor nerves from the cord; in the brain stem similar subdivision is expressed by the symmetrical disposition of twelve pairs of cranial nerves. Such a tendency to segmentation is proof that man's not very distant ancestors were quadrupeds and that more distant ancestors were the lower vertebrates. Man, together with the monkeys and half-monkeys, sends his roots deep down into the animal kingdom. And the prototype of his brain structure was that of the monkey or ape.

The brain of the lower monkeys such as the rhesus macaque or the baboon is bigger and heavier than that of the lemur and weighs between 50 and 100 grams; the olfactory bulbs are not very large and the gyri and other parts of the ancient olfactory regions of the cortex are poorly

developed, although they are more prominent than they are in man (fig. 67).

According to data provided by the researches of I.N. Filimonov (Institute of the Brain, Moscow) the main zone of the human cortex that is connected with olfactory functions and is, therefore, regarded as the ancient or palaeocortex, constitutes only 0.61 per cent of the total area (Filimonov, 1949). If the reduction of the olfactory zone in the human cortex is compared with that of a number of other Primates then, according to the same investigator, the "ratio of ancient cortex to the whole is greatly reduced in man as compared with the common marmoset (Hapale) (4.7 times)."

The neocortex, contrary to the palaeocortex, is the progressive part and in a number of Primates, including man, has reached a very high level of development (figs. 68 and 69). This has been achieved, in particular, by some regions of the cortex increasing in area in a manner that is specific for man alone. By way of example let us examine the inferior parietal zone of the neocortex in man and the monkeys.

Y. G. Shevchenko, of the Moscow Institute of the Brain, who studied this area of the cortex in the common marmoset (Hapale), guenon monkey, gibbon, chimpanzee, orangutan and man, established features of similarity in their basic structural outline and showed that the typical

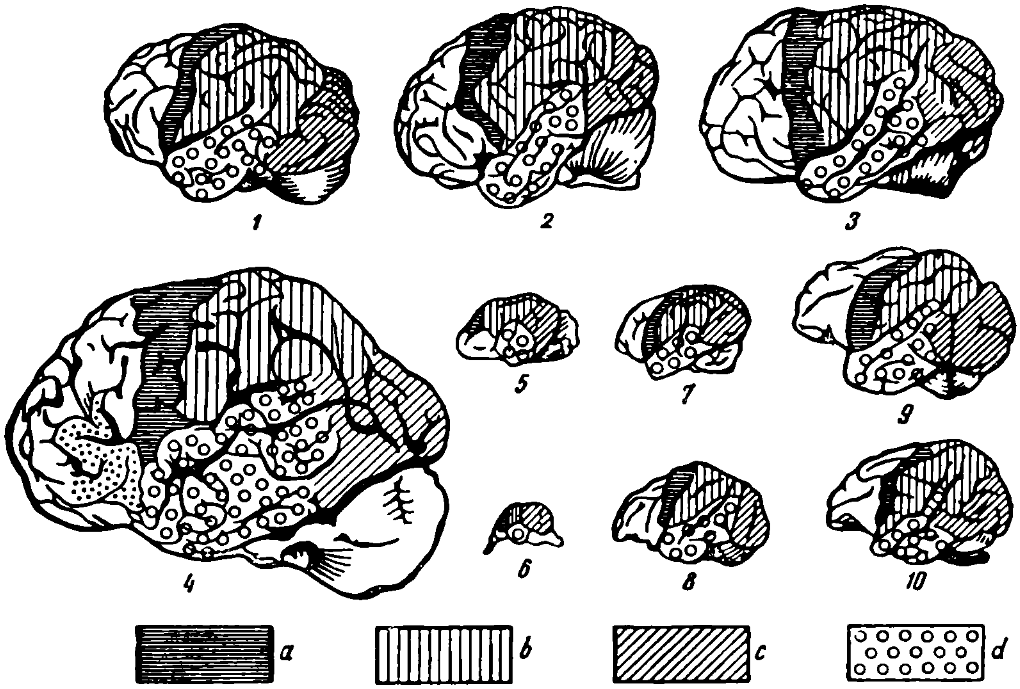


Fig. 69. Regions of cerebral cortices of Primates:

1—orangutan; *2*—chimpanzee; *3*—gorilla; *4*—man; *5*—lemur; *6*—tarsier; *7*—capuchin; *8*—macaque; *9*—baboon; *10*—gibbon; *a*—motor, *b*—sensory, *c*—optic and *d*—auditory regions. Left lateral aspect. Frontal lobe is unshaded (drawings show its progressive development from lemur and tarsier to anthropoids and man). Dotted area of frontal region of man's cortex shows motor speech area. $^2/_7$ natural size. After F. Tilney, 1928.

human areas 39 and 40 are also found in the anthropoid cortex (K. Brodmann, 1925). Simultaneously she discovered noticeable quantitative and qualitative differences. On the one hand, the boundaries between contiguous areas and subareas in this region of the anthropoid cortex are much more distinct than they are in man; on the other hand, the areas are much more weakly developed in the anthropoids and do not cover the whole inferior parietal region but only its superior divisions. In the common marmoset the inferior perietal region constitutes 0.17 per cent of the entire cortical surface, in the orangutan and chimpanzee it amounts to 3.3 per cent, while in man it has spread very considerably and covers 7.0 per cent of the total area (Y. G. Shevchenko, 1936-1938).

These ratios are very instructive: although the total area of the human cerebral cortex is three times that of the chimpanzee, the inferior parietal region in man is ten times greater than that of the anthropoids. Such a powerful development of the phylogenically new inferior parietal region in man is apparently due to its increased and more variegated functions under the influence of labour activities and speech (the second system of signals). In complicated nervous disorders a disruption of the functioning of this region is observed. The inferior parietal region, therefore, is closely connected with the functions of the second system of signals—speech, reading and writing; this phylogenically new region of the human cerebral cortex distinguishes man's brain qualitatively from that of the monkeys and apes.

The frontal region also possesses some exceedingly significant features that are phylogenically recent and which place the human brain at a higher level than that of an animal. At the Moscow Institute of the Brain this was studied in detail by Y. P. Kononova and she made a very important discovery: in the inferior frontal region of the chimpanzee brain she found areas that correspond to Brodmann's areas 44 and 45 in the human brain; scholars abroad have denied the presence of such homologues even in the anthropoids. She was even able to find traces of such areas, in the initial form, in some of the lower monkeys (Y. P. Kononova, 1949). Why are areas 44 and 45 so important to man? Scholars long ago noted the connection between this structure and the functions of articulate speech, and even named this part of the brain "Broca's speech centre" after the eminent French anthropologist, Paul Broca. It was later established, however, that not only the frontal region but also the inferior parietal and temporal regions play their part in speech functions. Investigations have shown that the motor zone of speech functions is, indeed, situated in the inferior frontal convolution. A pathological condition of this region of the left hemisphere causes motor aphasia and other speech defects in right-handed people.

The progressive nature of the development of the frontal lobe in man is proved by its other anatomical and physiological pecularities, such as its numerous associations with other regions of the brain through bunches of fibrils. This is confirmed by the belated myelinization of the

fibrils (as in the inferior parietal region), the relative enlargement of the frontal lobe in the course of evolution, and the noticeable complication of the pattern formed by sulci of all sizes due to the increased number of gyri on the surface of the cerebral hemisphere.

The temporal region is the next one connected with speech functions: it contains the sound reception zone, is concerned in particular with the reception of articulate speech, or, more broadly, of sound language. Research by S. M. Blinkov (1949) has shown that area 41, which has particular significance as the "auditory area" of the cortex, is more intricately differentiated in man than in the monkeys. The same must be said of the phylogenically new area of the posterior part of the temporal lobe. Man's brain is still more sharply distinguished from that of the monkey in the delicate structure of Brodmann's area 21 of the central subregion of the temporal lobe.

The importance of certain areas of the temporal lobe, particularly that part formerly known as Wernicke's zone (after a German neurologist) can be seen from their pathological state which is accompanied by an inability to understand words, i.e., sensory aphasia. Some diseases of the contiguous lobe, the occipital, cause verbal blindness or optical alexia, when the patient cannot recognize letters or whole words. This region, therefore, most probably plays an important part in functions that are specific to man alone, the functions of the second system of signals with which the entire cortex is, in one way or another, connected.

The occipital region of the cortex, where the cerebral end of the visual analyser is situated, is man's chief organ for the reception of visual images connected with the first and second system of signals. It is no wonder that investigators here, too, find considerable differences in comparison with the brains of other Primates; we may even say that in this region a noticeable qualitative reconstruction connected with the development from the simian to the human brain has taken place.

In this instance we shall again make use of research material from the Moscow Institute of the Brain where the brains of man, the apes and the lower monkeys were studied (N. S. Preobrazhenskaya and I. N. Filimonov, 1949). It was established that of the three Brodmann's areas of the occipital region, area 19 showed the greatest development and complicated structure, area 17 being very small. In man area 19 covers 4.5 per cent of the total surface of the cortex, that of the orangutan, 6.4 per cent, that of the lower (guenon) type of monkey, 6.0 per cent, while area 17 gave the figures of 3.0 per cent, 8.5 per cent and 10 per cent respectively.

From this it can be seen that the occipital region of the human brain has some peculiar features. In other words, areas 19 and 17 of the occipital region have developed in an entirely different way from that taken by the brains of man's nearest relatives, the apes or monkeys.

A different picture is presented by the location of the areas on the cerebral hemispheres: area 17 in man is not situated on the lateral

side but almost completely on the medial part of the hemisphere, as a result of the profuse growth of the parietal-temporal region of the cortex. In this region, too, is the spur-like fissure (fissura calcarina) that in monkeys is situated on the lateral side of the cerebrum at the pole of the occiput. In the lower monkeys the visual area of the occipital cortex has moved towards the parietal and has partially overlaid its posterior boundary. This has given rise to the simian sulcus that is clearly visible on the lateral surface of the cerebral hemispheres at the boundary of the parietal and occipital lobes.

In man the occipital lobe has been strongly constricted and has undergone some reduction of its relative dimensions; this is due to the growth of the inferior parietal, temporal and frontal lobes. From this it follows that progressive development of some parts of the cerebral cortex have caused the relative retrogression of other parts or elements. This is also true of the brain as a whole; on the basis of formerly existing features completely new, human features appeared during the process of anthropogenesis, while the simian features were weakened or disappeared altogether. This can be illustrated by another example.

On the boundary between the frontal and temporal lobes, deep down in the sylvian fissure is the central lobe or island of Reil (fig. 70). It can be found by moving back the margins of the fissure over which an operculum or cover is formed by the contiguous lobes, the temporal lobe included. The simian brain is somewhat different; the central (truncal) or insular lobe frequently protrudes on the surface between the abovementioned lobes and occupies a middle position (A. A. Deshin, 1934).

Cases of the enlargement of gyri (convolutions), for example, around the insular lobe, turning it into an island on the floor of the sylvian fissure, show that there is an intensive process of their development (gyrification) going on, accompanied by an increase in the number of sulci (sulcation), especially those of the second and third order.

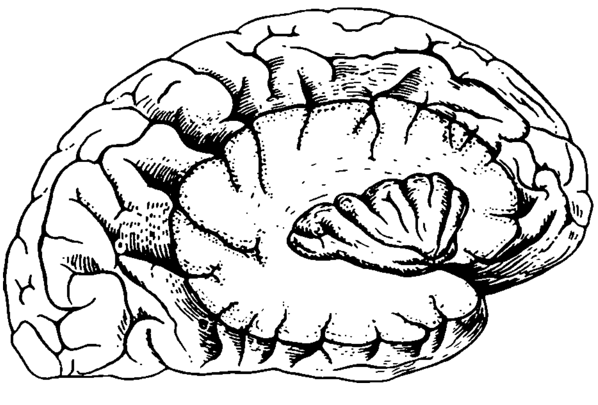


Fig. 70. Central lobe or insula of human cerebral hemisphere seen on floor of sylvian fossa after removal of tegumentum (operculum) formed by overlapping parts of frontal, parietal and temporal lobes.
After E. Villiger, 1930.

The process of growth in the human cerebral cortex is an expression of the transformation of the central organ of higher nervous activity in the course of the development of the human organism under the influence of labour and speech and distinguishes it from the evolution of the simian brain under the influence of purely biological, or, more widely, natural factors.

Although the intense processes of gyrification and sulcation of the human brain cortex are partially due to the growth in size of the brain itself, the basic reason is in the qualitative transformation of the internal cell composition of the cerebral hemispheres. It has been shown that the amazing complication of the delicate cortical cyto-architectonics is to a very great degree conditioned by the disproportionately rich composition of the nerve cells, the neurons with all their outgrowths.

The human brain has a volume three times that of the orangutan but the latter contains only 1,000 million neurons while there are not 3,000 million but at least 14,000 million in the human brain. This fact, as investigations have shown, accounts for the tremendous complication of links between the parts of the brain and again confirms the concept that the human brain is qualitatively different from the simian.

Thus, the material provided by modern science confirms the view that the human brain is the final product of an extremely long line of animal evolution. Towards the end of the prehistoric period, when the first men evolved from apes, there began an intensive development of the nervous system under the influence of labour and speech; human consciousness took form and this enabled man to gain an insight into the laws of nature and delve into his own origin.

The whole course taken by the study of the structure, development and functions of the human brain constitutes a complete refutal of the religious conception of the soul as a particle of the divine spirit controlling the human body, as the immortal double of its material aspect. The theory of the localization of functions in the brain shows that all psychic processes depend on the normal functioning of undamaged parts of the brain and on that most important organ as a whole.

The understanding of the normal functioning of the brain is greatly facilitated by Pavlov's profoundly materialist theory of conditioned reflexes. This theory, created by the great physiologist, proves irrefutably the existence of common laws governing the work of the nervous system in mammals and in man; it shows the common nature of their first system of signals and helps understand the peculiarities of ontogeny, phylogeny and the structure and vital functions of the human body that is the product of still more ancient stages of development of the animal kingdom.

Pavlov, moreover, on the basis of his physiological theories, evolved a conception of the second system of signals which is specific for man alone as distinguished from the animals; it would be difficult to overestimate the importance of this idea for the investigation of the most profound scientific and philosophical problems connected with speech and thought.

Pavlov's reflex theory serves as a convincing natural-scientific confirmation of Lenin's theory of reflection. In this way it throws a bright light on the problem of anthropogenesis insofar as the evolution of the brain as the organ of thought is concerned.

3. HIGHER NERVOUS ACTIVITY IN MONKEYS

Physiologists study the higher nervous activity of animals by the strictly objective method of conditioned reflexes. The physiological reflex theory, the theory of nervism, built up by the greatest Russian physiologists, I. M. Sechenov and I. P. Pavlov, forms the corner-stone of a single concept that enables biologists, anthropologists among them, to make a correct and profound materialist approach to the solution of some of the most difficult problems in evolution.

Pavlov's physiological theories are a powerful and effective weapon against the reactionary concepts that have been introduced into zoopsychology, especially in the U.S.A., Great Britain and Germany. The subjective method of investigating higher nervous activity must, in the end, give way to the objective method. Pavlov, it will be remembered, never permitted physiological experiments for the study of higher nervous activity to be described in the terminology of psychology. While he fought against dualist, idealist psychology he recognized the existence and development of materialist psychology as an established fact. The basis of materialist psychology lies in Marxist-Leninist theory, its method is connected with the reflex theory, and psychology itself is now indivisibly linked up with Pavlov's teachings. Such points of primary importance to the study of anthropogenesis as higher nervous activity, articulate speech (the second system of signals), thought and labour occupy a conspicuous place in Pavlov's work. Pavlovian physiology, directed entirely against idealism, serves as a sound scientific basis for the struggle that Soviet anthropologists are waging against a variety of anti-Darwinist anthropogenic hypotheses.

The behaviour of monkeys includes features that more closely resemble the behaviour of a human being than that of any other animal, and has been an object of interest to scientists for a very long time. As early as the eighteenth century, scientists, Georges Buffon (1707-1788), for example, studied the actions of monkeys and anthropoid apes. The greatest progress in the study of the behaviour, movements and instinct of these animals was made at the time when Darwin's theory of evolution penetrated victoriously into the various branches of biology, including zoopsychology.

Darwin, it will be remembered, wrote a fundamental work on the *Expression of the Emotions in Men and Animals* that was published in 1872. He regarded this book as a part of or an addendum to his other work, the *Descent of Man and Selection in Relation to Sex*. Darwin proved that man's expression of the basic emotions is very similar to that of the apes and monkeys and that this could only be treated as a case of genetic relationship between them.

The neglect or failure to understand the qualitative differences between man and the animals, a failing that was to some extent typical of Darwin himself, is clearly expressed in the writings of many zoopsychologists.

This has no doubt hindered the development of correct concepts of animal psychology and has, on many occasions, led to anthropomorphism in its treatment.

The German zoopsychologist, Wolfgang Koehler, carried out a detailed investigation of the behaviour of anthropoids. He had a number of almost wild young chimpanzees at his disposal and made a series of experiments to determine their "mental abilities." In these experiments some chimpanzees proved more capable than others in finding ways of getting at food in inaccessible places or hung high up out of reach: they moved boxes and climbed on to them, or made use of sticks. In one experiment a chimpanzee even learned to join two short canes or bamboo sticks together to make a long one. Koehler drew the erroneous conclusion that the chimpanzee possesses the human type of intellect.

A similar equating of man and animals is often to be met with among the American zoopsychologists, of whom a prominent place was occupied by Robert Yerkes. He studied the behaviour of the great apes and decided that in its level of intellectual development the gorilla (fig. 71) takes

Fig. 71. Young female mountain ape (Gorilla gorilla beringei Matschie), Miss Congo, poking food (fruit) out of pipe with aid of stick. R. Yerkes' experiment at Laboratory of Anthropoid Biology, Orange Park, Florida, U.S.A.

After R. and A. Yerkes, 1934.

first place, the chimpanzee second and the orangutan third. But Yerkes' most erroneous conclusion was that simians are capable of thought, expressed as sudden "illumination," "guessing" or "ideas." In other words Yerkes and Koehler both treated zoopsychological problems from the standpoint of idealism.

Soviet zoopsychologists show a different attitude to the problem of animal intellect and behaviour. We will examine the work of those who have made a special study of monkeys and apes in relation to the problem

of anthropogenesis—N. N. Ladygina-Kohts (Moscow), N. Y. Voitonis (Sukhumi) and G. Z. Roginsky (Leningrad).

N. N. Ladygina-Kohts studied the intellectual abilities and peculiarities of visual reception in a young chimpanzee, Johnny, using the original method of selection according to a sample (fig. 72). She usually made

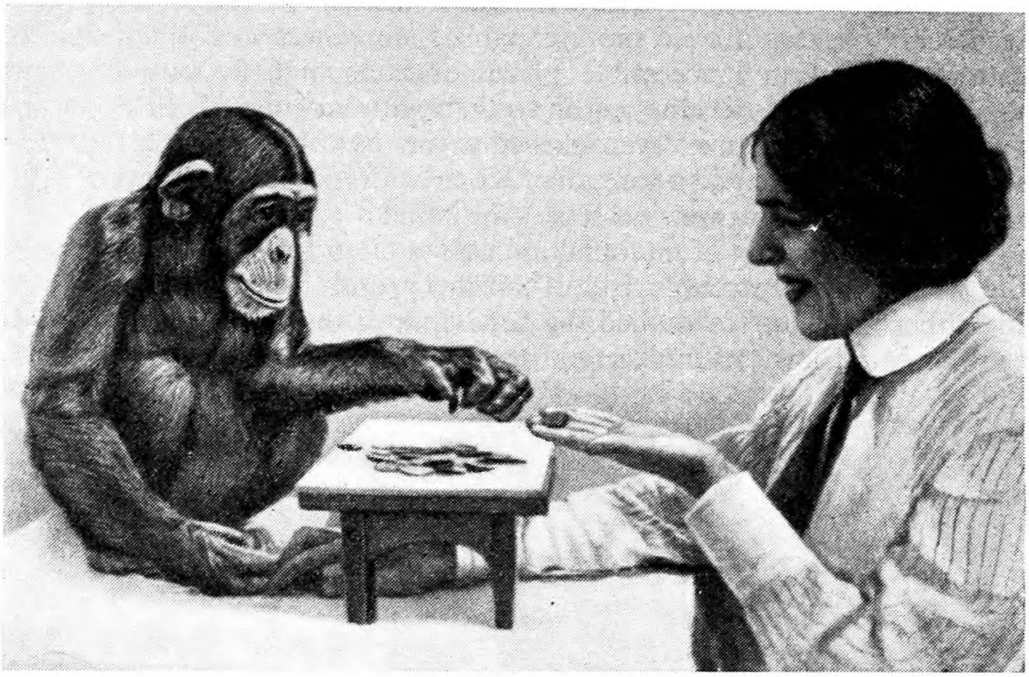


Fig. 72. Experiment with young chimpanzee, Johnny, who hands experimenter a disc of the colour shown him.
After N. Ladygina-Kohts, 1923.

her experiments as follows: a number of objects similar in shape but differing in colour were placed before the animal; she then took a similar object out of a box and showed it to the chimpanzee. It was able to select an object of the same colour and hand it to the experimenter.

Ladygina-Kohts made a number of experiments using this method and drew the following conclusion: "The behaviour is probably not so much 'foresight' as 'aftersight.' If we may say so, the chimpanzee has a reflective mind: only when it has practical experience in finding a solution can it begin to apply it correctly." The experimenter expressed the opinion (Ladygina-Kohts, 1923, 1924) that in this case there is a great difference between man and the chimpanzee, since the former, a reasoning being, "sums up effects and, having no need of concrete experience, draws the correct conclusions."

In addition to her experiments with the chimpanzee, Ladygina-Kohts worked with a rhesus monkey, placing various obstacles in the way to food or liberty. She drew a similar conclusion in respect of this animal:

"By the character of its elementary cognitive ability the lower monkey is very unlike, if not directly the opposite of, man" (1920).

By comparing the behaviour peculiarities of a young chimpanzee and a human boy of the same age, our investigator arrived at the conclusion that although the chimpanzee displays considerable qualitative differences, one may assume the existence of intellectual traits similar to those that must have been possessed by the most ancient hominids that later became reasoning human beings.

The different facial expressions of the chimpanzee were also studied by Ladygina-Kohts (1935) in the course of the lengthy observation of the behaviour, habits, instincts and expressive motions of the same young chimpanzee Johnny from the age of $1^1/_2$ to 4 years. She studied the expression of its face during such fundamental states as general excitement, sorrow, joy, fear, anger, astonishment, attention and disgust. The movement of the mouth and lips plays an important part in the chimpanzee's expression (fig. 73). When greatly excited the hair on its head, trunk, arms and legs stands on end. There were also other outward changes in the aspect and behaviour of the animal. Even in comparison with the gorilla and the orangutan, the chimpanzee is capable of astonishingly rich mimicry that closely resembles that of man.

The great apes have a range of facial expression that is much richer than that of the gibbons and the lower monkeys but is, nevertheless, inferior to that of man. The superiority of man in this field is due to the very great variety of functions of which the facial musculature and its nervous system are capable; the human kinaesthetic analyser is more highly developed, the innervation of the facial muscles is very intricate, the muscles are strongly differentiated (fig. 74) and the connections with the brain are of a complex nature.

The evolution of the facial musculature of Primates was studied in detail by E. Huber (1931). He lays great stress on the central nervous system, its high level of development being a prerequisite to the complication of the facial muscles with their wealth of emotional expression. They become more varied as the number of connections between the different regions of the cerebral cortex increases. Huber said that "while facial expression among the lower Primates is confined to a simple scheme with a few stereotyped features, it becomes richer and more perfected as one goes up the ladder until it reaches an amazing degree of variability and complication in the great apes and of the latter the great African anthropoids, the gorilla and chimpanzee, most nearly approximate man, the orangutan being further removed."

Even the gorilla and chimpanzee, however, cannot compare with modern man in their range of facial expression, since man's ancestors, in addition to the above-mentioned natural biological factors (including progress in the corresponding area of the motor zone of the cortex due to erect locomotion and the use of tools), developed under the very powerful influence of social factors that promoted the perfection of the brain

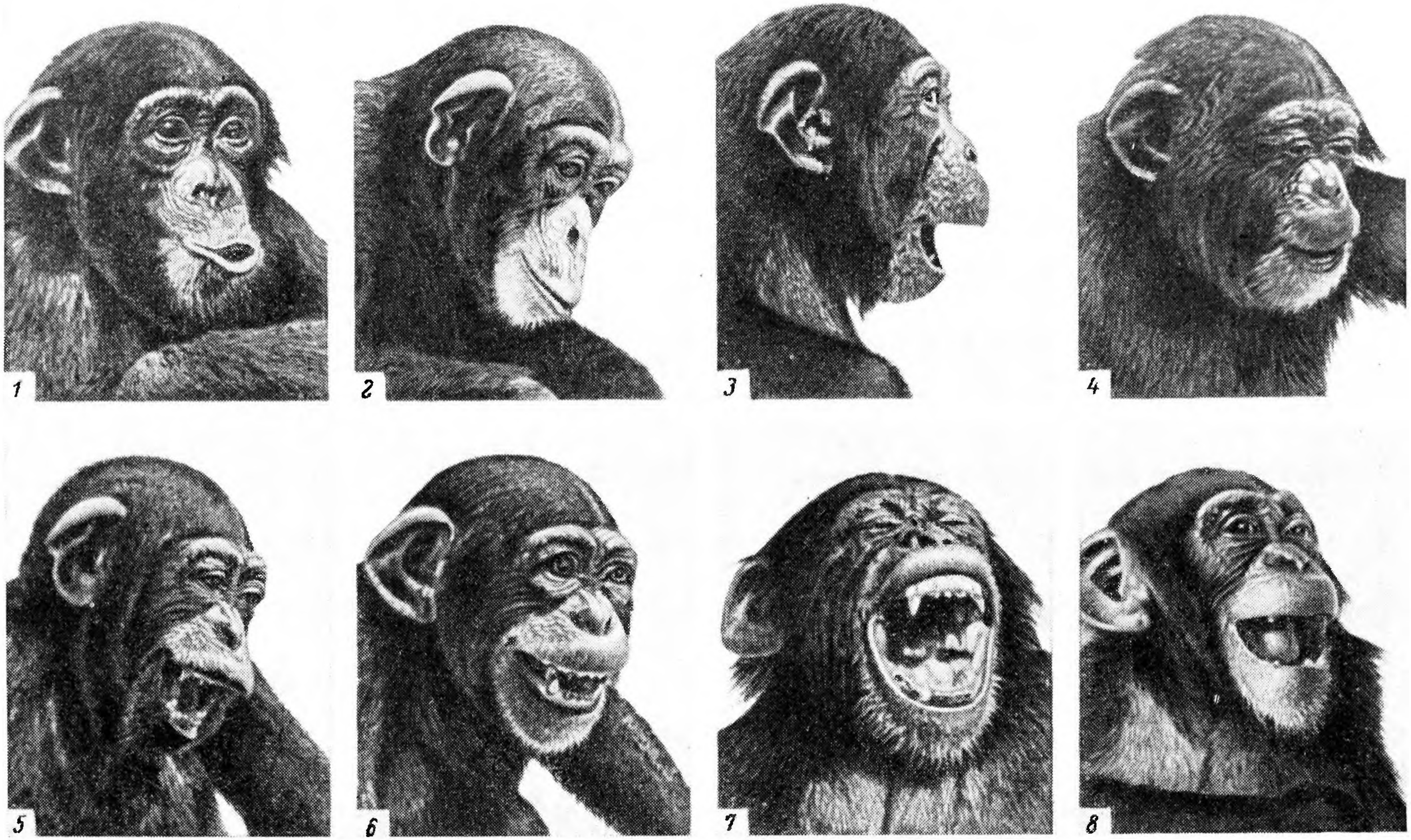


Fig. 73. Facial expressions of young chimpanzee Johnny:

1—excitement; *2*—attention; *3*—astonishment; *4*—disgust; *5*—anger; *6*—fear; *7*—sorrow (crying); *8*—joy (laughter). After N. Ladygina-Kohts, 1936.

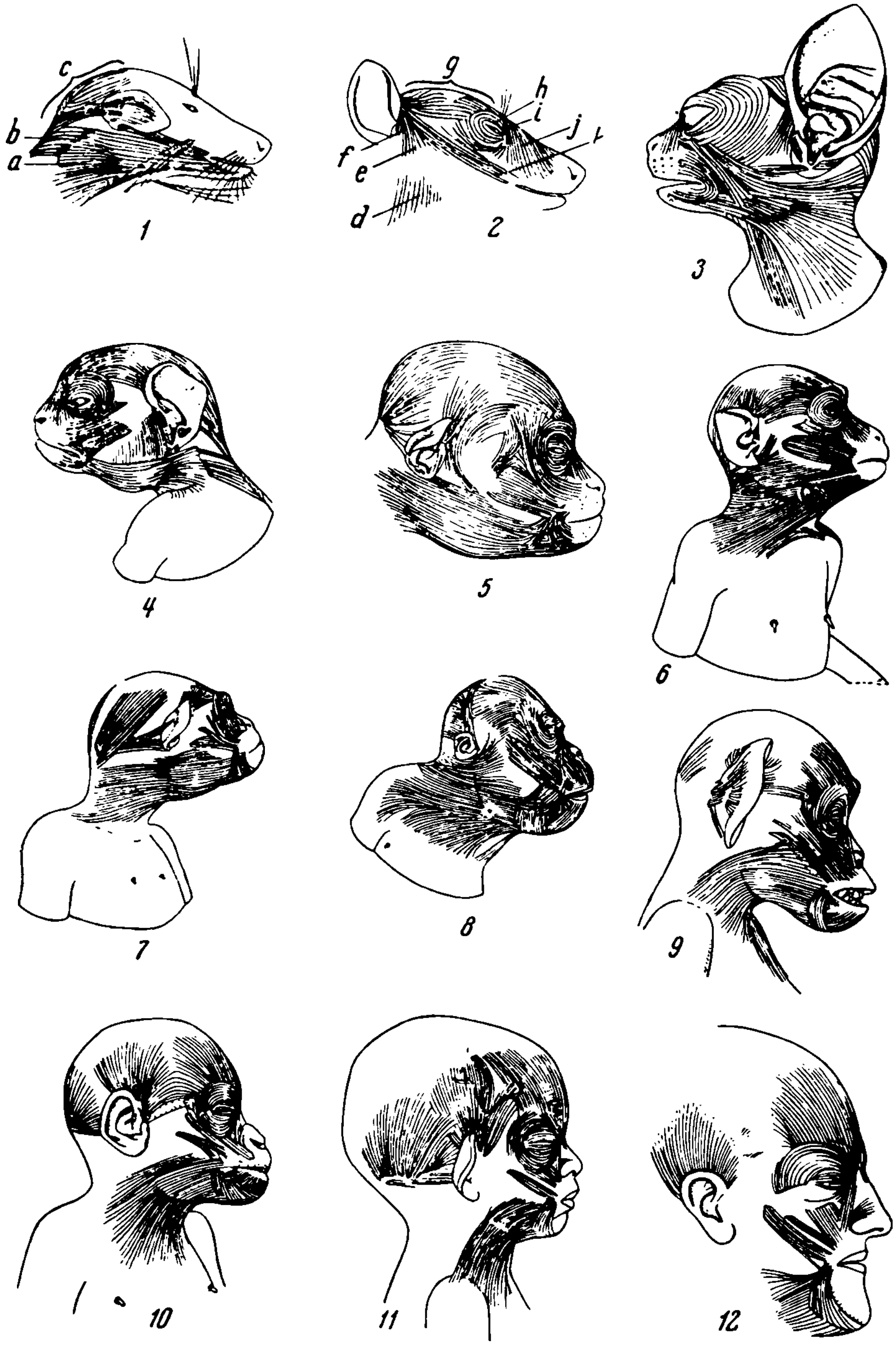


Fig. 74. Facial musculature of Primates:

1 and *2*—diagrams of basic structure of superficial facial musculature of Primates as seen in lemurs, tarsiers and primitive American monkeys; *3*—Horsfield's jumping tarsier (T. saltator Elliot); *4*—lion marmoset (Leontocebus = Oedipomidas rosalia L.); *5*—black spider monkey (Ateles ater F. Cuvier); *6*—rhesus monkey (Pithecus = Macacus rhesus Audebert); *7*—Siamese capped gibbon (Hylobates pileatus Gray); *8*—orangutan (Pongo pygmaeus L.) (not fully grown male); *9*—common chimpanzee (Pan chimpanse Meyer); *10*—coastal gorilla (Gorilla gorilla Matschie) (young female); *11*—European infant; *12*—adult European; *a*—platysma (superficial); *b*—platysma (inferior); *c*—group of posterior auricular and occipital muscles; *d*—ventral part of anterior auricular section of deep cervical sphincter; *e*—dorsal part of sphincter muscle that raises and lowers ear; *f*—tragio-cochlear muscle; *g*—group of anterior auricular, temporal and frontal muscles; *h*—orbital muscle; *i*—muscle lowering supra-orbital region; *j*—naso-labial muscle; *k*—zygomatic or cheek muscle. After E. Huber, 1931.

and the psyche, the musculature of the face and facial expression in the very earliest men.

"The acquisition and gradual perfection of articulate speech must have acted as the direct promoter of development both of the musculature of the face and its expressiveness," said Huber. "The beneficial influence of speech on the facial musculature of ancient man and the development of the muscles of expression in modern man," Huber went on to say, "still continues in the muscles of the supra-orbital regions and the glabella that connects them, as well as in the muscles around the mouth."

The newborn infant's face has relatively poorly differentiated expression because the sensory organs and the cortex are insufficiently developed, although at the time of birth the facial muscles are, in the main, fully developed. It must be mentioned, however, that negative reactions in the form of expression have been noted in foetuses a few months old (P. K. Anokhin, 1957). In infants the functional activity of the facial muscles is not fully evolved at birth, although it develops very rapidly, especially during the first year of life and then somewhat more slowly during the next two years. The facial muscles of an adult are very highly differentiated. Actors, by lengthy and careful training, are able to achieve the very finest degrees of facial expression. A tremendous variety of expression—laughter, anger and other emotions—can also be observed in everyday life. The oral muscles are well developed for various shades of laughter and draw back the angles of the mouth, exposing the teeth. The oral muscles of the apes are not so highly differentiated: the baring of the teeth is mostly an expression of anger, although at times, in the chimpanzee, for example, it may be an expression of laughter (G. Lefrou, 1956).

A typical trait in the monkey, especially in its youth, is its interest in all objects in the world that surrounds it, irrespective of whether they are edible or not. N. Y. Voitonis (1949) made a special study of the "orientational-investigating activities" of lower monkeys. He established that the monkey is not only attracted by the newness of an object, but also by the intricacy of its structure and the extent to which he can operate on it. The baboon and the rhesus monkey differ from the anthropoid apes in one respect—their interest in an object is not increased if it emits sounds.

The monkey's curiosity in something new and interesting is so great that it may be stronger than hunger and will make the animal examine the object from all sides. Such great curiosity in the objects in their environment has no doubt been developed by its way of life: the monkey has a fairly well organized brain, excellent vision and prehensile fore limbs; it is able to obtain a varied diet in its natural habitat and reacts in different ways to the phenomena and objects in its environment. Voitonis drew a very important conclusion: the orientational-investigating impulses of the monkey which, says Pavlov, are peculiar to it, even in the lower

monkeys greatly exceed what is required by the search for food. In this we see a valuable confirmation of Darwin's idea that our ancestors must have been apes capable of using objects in order to obtain food. Voitonis' conclusions, on the other hand, make it necessary for us to seek the roots of some of the distinctive intellectual peculiarities of man in the fossil monkeys or apes of the distant past.

Augmented interest in objects was, however, in itself insufficient to make our ancestors turn to the use of tools and to work with them. These extinct apes had also to possess the ability to note the relationships between objects and change them, either by the use of their natural organs or by the use of some object that could serve as a tool in the hands of the monkey. Voitonis established that the lower monkeys not only possess such an ability but that it is manifested in an original way; in addition to augmented interest in a particular objective and persistence in achieving it, the lower monkeys make use of the most varied objects and often easily abandon an unsuccessful attempt and turn to a more successful method after several, even many, attempts.

Voitonis arranged a very interesting series of experiments in which a young pigtailed macaque (Macacus nemestrinus L.) learned to get water or sand from a shallow well with a bucket and to reach an apple with the aid of a long fork (fig. 75). Another young male of this species

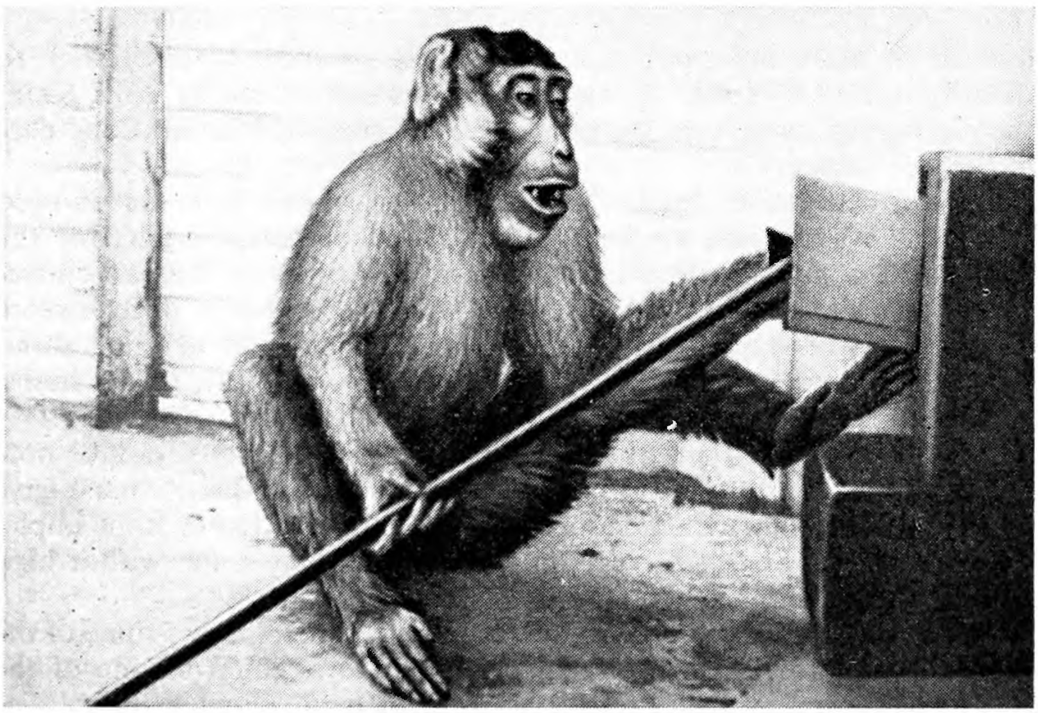


Fig. 75. A. I. Katz's experiment with macaque Pat at the Sukhumi Medico-Biological Station: monkey uses a stick with a forked end to reach an apple in a deep wooden box, the "experimental well," lying on one side.
Photo from Archives of Moscow Institute of Anthropology.

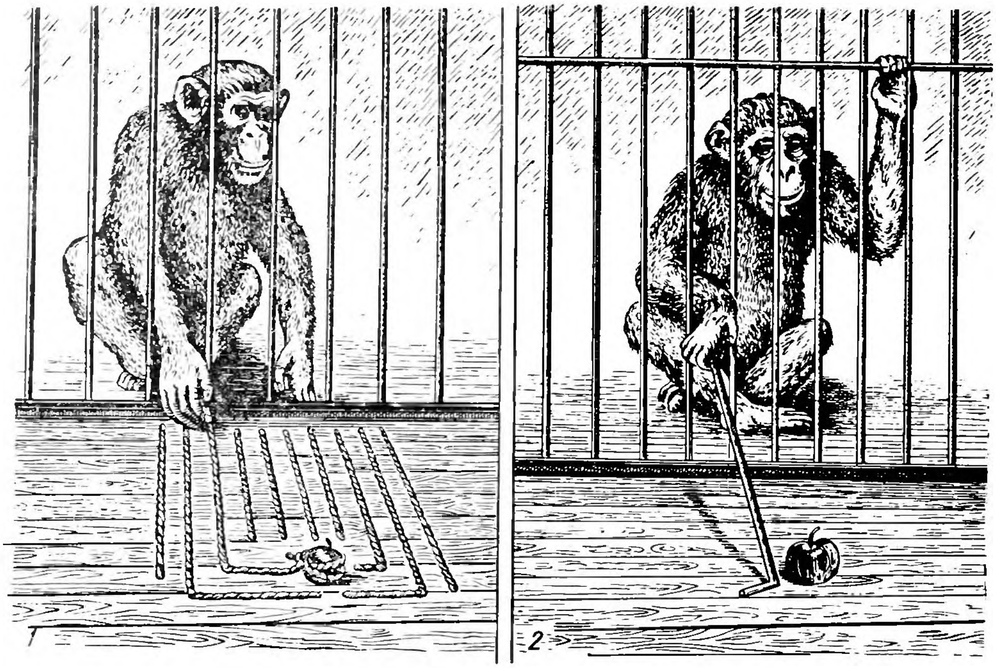


Fig. 76. Experiments with a chimpanzee:
1—ape selects a tape to which an apple is tied; *2*—ape manipulates a crooked stick to reach an apple. After G. Roginsky, 1948.

learned to make independent use of a long or short crooked stick to obtain food. (This series of experiments was carried out by A. I. Katz; the photograph was taken from the thesis he presented for his Candidate of Science degree.)

These investigations led to the establishment of new facts that showed that monkeys are able to form intricate and persistent habits for the attainment of an objective even when no food was used as an enticement. Man's ancestors must have possessed this ability in a much more developed form. They must have been able to use tools to bring about changes in the relationship between objects, for example, to dig bulbs, roots, grubs, insects and their larvae out of the ground.

According to Voitonis' investigations the lower monkeys take note of the details of objects to an amazing degree. Such a quality must have had great significance for our ancestors in the fabrication of stone implements which at first were very crude but were later made with a high degree of skill.

The work carried out by Voitonis, therefore, by explaining some of the typical behaviour features of the lower monkeys, confirms one of the basic conclusions of Darwinism; the roots of man's intellectual abilities must be sought in the mental powers of his simian-like ancestors (so far as can be judged by modern monkeys); his investigation, on the other hand, is an excellent illustration of Engels' idea of the importance of the hand in the transition from ape to man.

Platyrrhine monkeys of the capuchin type also displayed a tendency to handle tools, very great curiosity and a persistent interest in new objects during experiments. The investigations made by G. Z. Roginsky (1940) demonstrated the high degree of development reached by the capuchin monkeys and revealed the important role of the visual receptor for the correct solution of a problem; the capuchin monkey proved capable of rapid reorientation when the conditions of the experiment were changed. Experiments made by J. A. Bierens de Haan (1931) and H. Klüver (1933) also revealed the quick-wittedness of the capuchin monkeys.

Of still greater interest were Roginsky's experiments with chimpanzees in connection with the problem of the initial steps (1948) in intellectual activity (fig. 76). Roginsky took into consideration the biological specifics of the monkeys who have highly developed organs of sight and touch combined with special locomotor abilities and who differ noticeably from other Mammalia in a number of other features.

It is important to take into account the monkeys' conditions of life in freedom because their behaviour is biologically very complex as compared with that of other mammals, although their congenital, unconditioned reflexes can hardly be quantitatively greater. Behaviour is not the simple sum of various reflexes or their association.

Roginsky's investigations showed that the chimpanzee's behaviour is distinguished by its great plasticity, adaptability to circumstances, well organized activity in difficult situations; individual experience proved of great importance. Contrary to Koehler, the Soviet scholar showed that the chimpanzee is by no means "a slave of its field of vision," but is capable of easily changing one situation for another and of making use of a stick as a tool more rapidly and more agilely than the lower monkeys (G. Z. Roginsky, 1948, 1953). Of outstanding interest to the anthropologist studying the process of anthropogenesis are those transformations in higher nervous activity that must have taken place during the evolution of man's ancestors, particularly of the fossil Primates.

Engels describes man's immediate ancestors as unusually highly developed anthropoid apes who far exceeded all others in intellect and adaptability. The concept of "adaptability" is, through the cortex, more closely connected with the general biological, anatomical and physiological qualities of the organism, but "intellectuality" must be computed by the activity of the cortex itself together with the central regions of the analysers.

Soviet anthropology is closely linked up with Pavlov's teachings on the laws of higher nervous activity which it employs organically for the solution of its problems. Pavlovian physiological theories in their entirety have outstanding importance in their application to anthropogenesis, they provide a better understanding of how a "being with a thinking brain" evolved on Earth, how there appeared that most complicated organism in which, as Engels said, "nature achieved cognition of herself."

Pavlov's materialist theory of higher nervous activity in man and the animals, the direct opposite of the idealist physiology and psychology of reactionary bourgeois scientists, is an aid to the struggle against various shades of idealism in the science of man that are at times extremely refined. Typical of Pavlov's philosophy is the materialist conception of man's evolutionary development.

Pavlov connected the problem of anthropogenesis with the specific features of higher nervous activity in the animals that he studied from the evolutionary standpoint. In 1913 he wrote: "Charles Darwin may justly be considered the initiator and inspirer of the modern comparative study of the higher manifestations of animal life; as every educated man knows, in the latter half of the last century his masterly illustration of the idea of development engendered greater fertility in the whole mental activity of mankind and especially in the biological branches of natural science. The hypothesis of man's descent from the animals gave the study of higher manifestations in animal life an enthralling interest. The answer to the question of what is the most useful way to carry out that study and of the study itself constituted problems of the post-Darwin period."

Pavlov's investigations opened the way for the profound study of problems connected with the evolution of the intellect. In his endeavour to establish phylogenic relationship between man and the animal kingdom, Darwin concentrated on their common anatomo-physiological features. Pavlov established real similarity in the physiology of human and animal brains, but at the same time stressed their qualitative differences and propounded the idea of the second system of signals that is natural to man alone.

In accordance with his own materialist conception Pavlov had for a long time combatted the dualist views on human nature that were typical for British scholars like Sherrington, Americans like Lashley and Yerkes or Germans such as Koehler. Being a "quite odious person" to foreign and Russian idealists, Pavlov always combatted their anti-materialist views, their animalization of man. He also objected to their anthropomorphization of higher nervous activity in animals, i.e., ascribing to them ideas or generalizations that man alone can possess on the basis of the second system of signals; he objected to their acknowledgement that the higher nervous activity of animals is intellectual and not mere practical rationalism. Such fallacies as these are typical among scholars of the type mentioned above who freely equate the behaviour of man with that of the animals. Pavlov's theoretical and practical physiology is distinguished from theirs by being permeated with the spirit of dialectical, militant materialism (E.A. Asratyan, 1951).

Psychologists, biologists and anthropologists of the materialist school must hold Pavlov's principle of determinism in high esteem for it may be applied to explain the process of anthropogenesis as opposed to the many teleological concepts that are based on the unscientific proposition that the nature of the universe and man is unknowable and admit the

intervention of supernatural forces. As an example of the fallacious theories propounded by certain American scholars, we shall cite the "theory of telefinalism" in the evolution of the organic world proposed by Lecompte du Noüy of the Rockefeller Institute, New York; it is outlined in his book *L'homme et sa destinée*. He maintains that the basis of evolution is supernatural pre-ordination and that God created man by a miracle, exactly as portrayed in the Bible. Telefinalism is only one of the many variations of that dominant tendency of reactionary American biologists who, in many books and articles, defend the principle of "Creation Through Evolution."

Pavlov's approach to the problem of the mutual relations between different reflexes and their changes took into consideration the dominant influence of the external environment on the organism.

Studying the problem from the standpoint of general biology, the Darwinist position, Pavlov showed that individual adaptation is common to the entire animal kingdom, that unconditioned reflexes and their combinations in the form of instinct constitute a species type of adaptation, and that temporary connections—conditioned reflexes and associations—serve as an individual form of "balancing" the organism with its environment, i.e., adaptation.

In 1935 he wrote: "The type of behaviour in man and an animal is conditioned not only by congenital properties of the nervous system, but also by those influences that have affected and are constantly affecting the organism in the period of its individual existence, i.e., it depends on constant training or teaching in the broadest sense of those words. This is because the most important property of the nervous system, its plasticity, functions constantly and simultaneously with the above-mentioned properties."

Pavlov's ideas and his practical achievements—a brilliant development of the scientific precepts of I.M. Sechenov, a great Russian scientist who laid the foundations of the materialist physiology of man and the animals—are still significant to modern Soviet physiology. Concrete investigations reveal the truth of Pavlov's statements on the changing character of conditioned and unconditioned reflexes and on the close genetic relations between them.

The basic idea of the transition of simple to complex reflexes was pronounced by Pavlov as early as 1922 in connection with his concept of the occlusive functions of the nervous system. If this basic thesis of Pavlov's physiological theory be applied to that stage of simian development when the apes changed their arboreal for a terrestrial way of life, the anthropologist is enabled to find an explanation of the nerve mechanism that brought about a profound change in the performance of many reflex actions as our ancestors adapted themselves to new environmental conditions in Upper Tertiary times.

The study of the higher nervous activity of monkeys was begun on Pavlov's instruction in his laboratory in 1923 by A.G. Ivanov-Smolensky

and D.S. Fursikov and was later continued by a number of investigators who worked with the higher apes as well as with the lower monkeys.

Pavlov was greatly interested in the higher nervous activity of monkeys and tried to establish their qualitative peculiarities. He compared the Primates with the other mammals and with man: "If we consider it once again, if we say why the monkey has been more successful than other animals, why it is closer to man, it is because it has hands, four hands even, i.e., more than you and me. Thanks to this it is able to enter into very complicated relations with the objects that surround it. This is why a mass of associations is built up by the monkey and not by other animals."

In other words the considerable development of analytico-synthetic processes in the cerebral cortex is typical for monkeys. This is connected, in particular, with the high level of evolutionary development of the monkey's analysers that enables it to make a more complicated analysis of the external world combined with the synthesis of certain elements and aspects of it. Of particular importance are the various motor signalling nerves, the highly developed motor apparatus and kinaesthetics.

"As these motor associations must have their material substratum in the nervous system and in the brain," continues Pavlov, "the cerebral hemispheres of the monkey brain have developed correspondingly more than those of other animals and have developed precisely in connection with the variety of motor functions. We, in addition to a variety of hand movements, have the complex system of speech movements."

Pavlov's physiological theories enable us to treat the problem of the inception of labour activities in man's immediate ancestors on a new factual, materialist basis and in the light of new theoretical concepts. Pavlov came very close to the labour theory of anthropogenesis propounded by Engels. This makes it possible to tackle the problem of the early stages of human thought. Pavlov observed the chimpanzee Raphael build a pyramid of boxes and other wooden objects to reach a bait that had been hung high up overhead, and gave the following estimate of this action: "I say this is intelligence, all this activity in which the ape tries first one thing and then another, this is thought in action." Further: "You are actually the eyewithnesses of our thought development, you see all the obstacles in its way and all its methods. There is intellectuality in this and Herr Koehler rejects it: this he avers, is the method of trial and error."

Many reactionary physiologists and psychologists abroad interpret incorrectly the higher nervous activity of apes, animals that are so close to human beings, by ascribing to them human psychic qualities. Yerkes considers that apes are "almost people." Koehler finds that they have intellects of the human type. The qualitative differences between man and the apes, therefore, is obliterated. Others, on the contrary, draw too sharp a line between man and the animals by ascribing to the former particles of the godhead, i.e., the immortal soul.

When Pavlov speaks of "primitive thought" he gives the term a purely physiological content with due account taken of the qualitative differences that distinguish it from the human intellect. He says, for example, that "psychologists who try to get away from the truth, like Yerkes or Koehler, make use of such empty conceptions as—the monkey went away, 'thinking itself at liberty' as a man would, or 'the monkey decided the matter.' Of course that is all nonsense, a childish and unworthy solution of the problem. All Raphael's 'behaviour was confined to analysis and association.'"

In minimizing the differences between man and the monkeys, idealist scholars are supporting the vitalist theory of the origin of man and combining it with the conception of a body and a soul that are independent, the latter dominating the former. This provides the contradiction that is typical of such scientists, the "religious science" that is cultivated in capitalist countries. According to the concepts of some reactionary biologists in the U.S.A. the divine creation of the world is proved by its development. The writings of such people affirm the truth of the Biblical myth of the creation of first people. A similar distortion of the truth in the science of life and of the origin of man, especially in works on the brain and higher nervous activity, is also to be found in the writings of some English idealist scientists.

When Pavlov read the writings of an English reactionary scientist of this type, he wrote indignantly that the naturalist "was prepared to admit intelligence in animals, as many people did, but he nevertheless distinguished those animals from man and denied the origin of man from animals and objected to our conception of ourselves as the continuation of the animal kingdom." Concerning the same naturalist, Pavlov wrote: "I have long been astonished at the way in which man has managed to dig such a ditch between himself and the animal."

Pavlov's ideas have been elaborated with great profundity in the work of his pupils and followers. Some basic work on the higher nervous activity of apes was carried out on the same chimpanzee, Raphael, and his female companion, Rosa, under the direct supervision of Pavlov himself (fig. 77) in the laboratory at Pavlovo (formerly Koltushi) near Leningrad. For a number of successive years the behaviour of the chimpanzees was studied. E. G. Va-

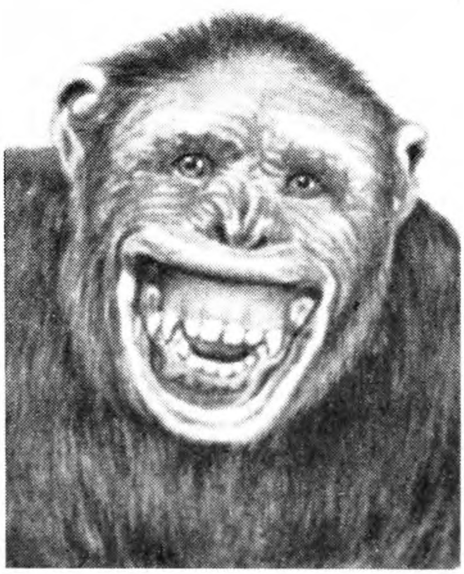


Fig. 77. Chimpanzee Raphael.
After E. Vatsuro, 1948.

tsuro, with other workers at the laboratory of higher nervous activity, made a large number of experiments (E.G. Vatsuro, 1948, 1955; P.K. Denisov, 1958). Pavlov spent a great deal of time at the cages in which Raphael and Rosa were kept. The behaviour of the anthropoids and their higher nervous activity proved of great interest to him.

Experiments involving the removal of food from closed boxes by means of sticks having a round, square, triangular or other cross-section to correspond with the holes in the lids of the boxes are of great interest to us. Raphael proved clever enough to employ the most varied methods to obtain fruit and berries hung high up out of reach: he put a pole in position and climbed up it, piled boxes one on top of another and also made use of other objects of different shapes. No less interesting was his method of placing poles from one raft to another in order to get at his breakfast.*

There were also some interesting experiments with fire: an apple was placed in a dish on a table and lighted candles were placed round it. Raphael could not get at the fruit without burning his hands and used various methods to put out the lights, either blew them out or struck them with a hammer. In other cases he doused the fire with water (fig. 78), or took water in his mouth and squirted it on the flames.

A very instructive experiment was that in which the ape showed its ability to fasten two sticks together to make a longer one. Vatsuro's work led him to the conclusion that the chief factor in the behaviour of anthropoids is the kinaesthetic impulse, i.e., that priority of place must be given to motor-sensory, kinaesthetic perception and not to visual perception.

Vatsuro opposed Koehler's theory that the monkeys are the slaves of the field of vision. The Soviet investigator also rejected another Koehler theory that ascribes to the chimpanzee an intellect similar to that of man. Koehler removes the boundary between man and monkey, anthropomorphizes the ape and, at the same time, animalizes the man when he ascribes to the ape or monkey the ability to consciously fabricate tools.

In their use and even in their accidental combination of the simplest "tools" the monkeys' behaviour only partially resembles what we assume to be the *modus operandi* of our ancestors in those distant times when they lived in herds and began to use natural objects as their primitive tools.

There can be no doubt, however, that the study of simian behaviour is an extremely valuable contribution towards explaining the process of anthropogenesis. The similarity of some basic features of behaviour (higher nervous activity) and the expression of emotions, indicate

* On Pavlov's instructions a cinema film of about 3,000 metres of "Rosa and Raphael" (3 parts) was made; another film "Experiments with a Chimpanzee on Rafts" (5 parts) was also made.

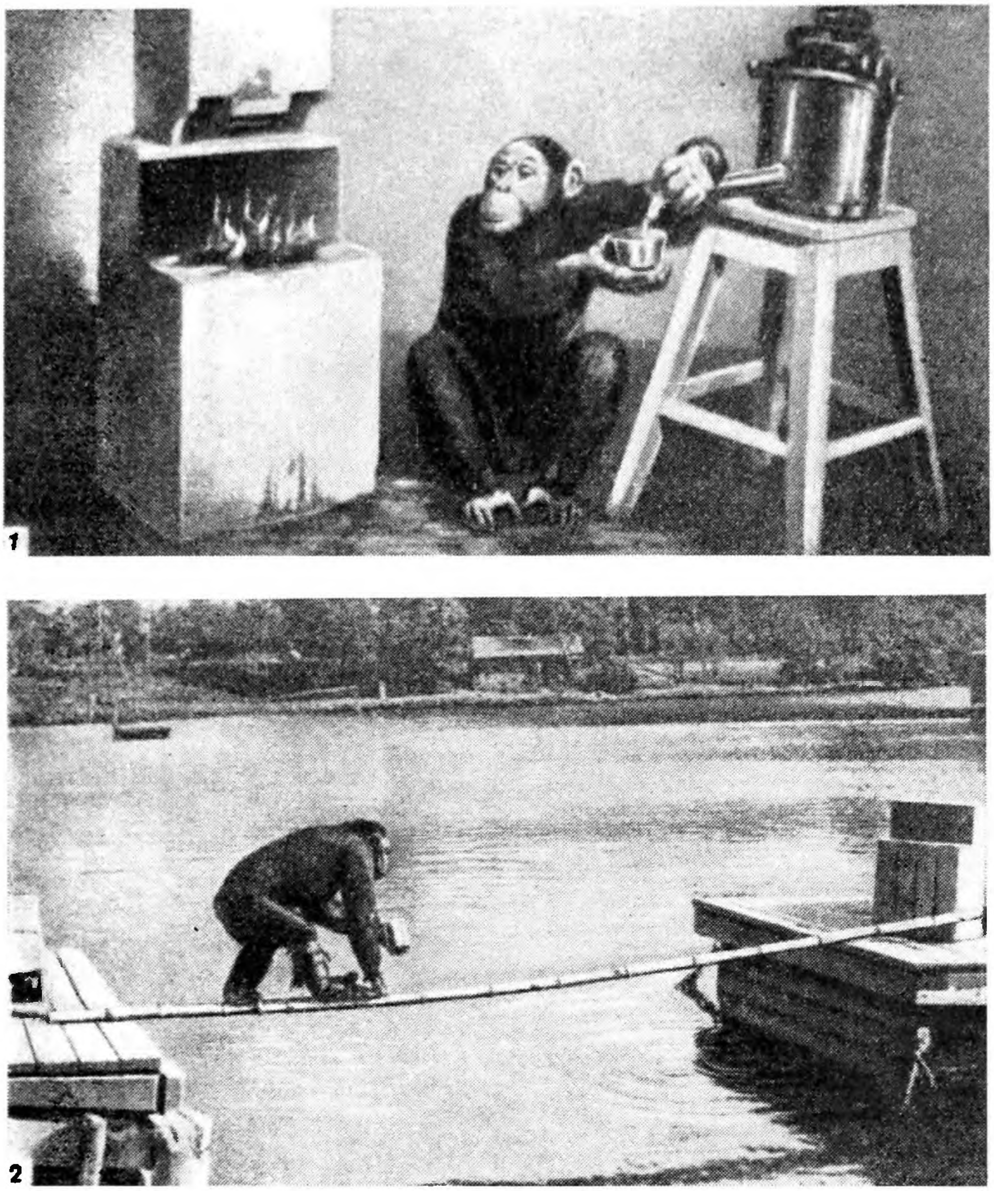


Fig. 78. Experiments with chimpanzee Raphael:
1—extinguishing fire; *2*—on rafts. After E. Vatsuro, 1948 (*1*), and G. Roginsky, 1948 (*2*).

the general line of development followed by the brain and the sensory organs in the ancestors of man, apes and monkeys.

The observations and experiments carried out on monkeys at the Pavlov laboratories and at the Sukhumi Medico-Biological Station by Pavlov's pupils and followers during the past quarter of a century, confirm Darwin's theory of man's descent from the animal kingdom, and on the basis of the new materialist physiology reveal the closer phylogenic relationship between man and the higher Primates, the apes and monkeys.

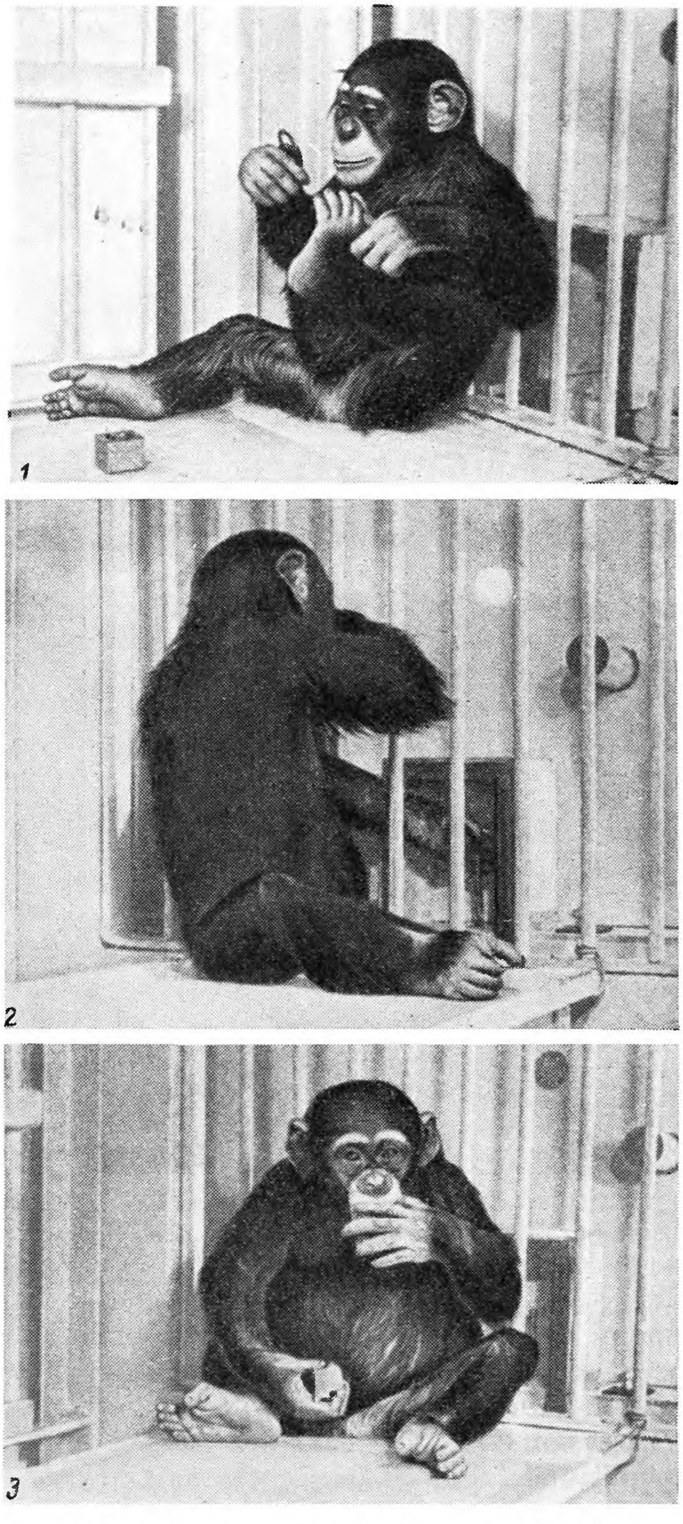


Fig. 79. Experiment with chimpanzee Lada. Light signal indicates that food has been placed in a box to which entry is effected by a door the in wall outside the cage: *1*—before experiment; *2*—signal has been switched on (round opening is uncovered); *3*—food in ape's hands. After N. Rokotova, 1953.

The higher nervous activity and behaviour of monkeys are conditioned by the historically developed relations of the organism to its environment that constitute the characteristic features of the species. According to L.G. Voronin (1952, 1954), who used Pavlov's methods to carry out important research at Sukhumi and Koltushi, monkeys possess very highly developed imitative ability, well expressed orientational-investigatory reflexes, a means of signalling by sound and gesticulation reflexes and strong nervous processes of excitation and inhibition.

The biological importance of the conditioned reflex activity of animals is also shown by the experiments made by L.G. Voronin and his assistants at the Pavlov Laboratory at Koltushi, studying the comparative physiology of higher nervous activity in vertebrates (N.A. Rokotova, 1953).

The sum of conditioned reflexes accumulated by the animal in the course of its life constitute its individually acquired experience, the character and volume of which depends on the animals' natural ability that has its roots in the specific qualities of its nervous system. This experience, furthermore, is not without some influence on the nature of higher nervous activity in successive generations as a result of inherited features.

Man has an abundance of conditioned reflexes due to his complicated social surroundings, his labour processes in production, his constant association with others of his own kind and his very complex brain. Typical of man is his highly developed psyche and behaviour, both qualitatively different from those of the animals, conditioned by the specific development of a second signalling system that is common to all animals. According to Pavlov, in the course, in addition to the first, of man's evolution there has arisen, in addition to the first signalling system of conditioned reflexes, a second system consisting of oral and graphic symbols; these can depict everything that people perceive directly from the outside world and from their own inner world.

4. THE SECOND SIGNALLING SYSTEM—THE DISTINGUISHING FEATURE OF HUMAN THOUGHT

When Pavlov was reviewing more than half a century of extremely rich scientific work and pondering over those features that distinguish man from the animals, he came to the conclusion that the qualitative differences are to be found, first and foremost, in the structure and functions of the brain, in higher nervous activity. In his search for that quality that most sharply typifies man and helps form those specific features we have discussed above, he developed the concept of the second signalling system.

Pavlov describes it thus: "In the developing animal kingdom, at the phase of man's emergence, there occurred an extraordinary addition

to the mechanism of nervous activity. The first signalling system of reality is also possessed by man. But the word constituted a second, our special system of signalling reality and is the signal of the first signals. The numerous irritations effected by the spoken word, on the one hand, led us away from reality and we must, therefore, always remember this in order not to distort our relations to reality. On the other hand, it was precisely labour and the word that is connected with it that made men of us, concerning which, of course, there is no need to speak here. There can be no doubt, however, that the basic laws that have been established for the first signalling system must also govern the second, because it is a function of that same nerve tissue."

When Pavlov spoke of the laws governing the activity of the nerve cells and conductors in carrying out the functions of the first and second signalling systems in their relation to the spoken language, he was well aware that the two methods of communication are qualitatively of different value and this not only because the second developed on the basis of the first, but because the spoken word, articulate speech, is one of the most amazing factors distinguishing man from the animal kingdom.

In his writings Pavlov again and again stresses the difference in principle that exists between the first and second system of signals.

"Of course, for man the word is just as much a real conditioned stimulus as all those others that are common to him and the animals, but at the same time it embraces such a wide field that there are no other conditioned stimuli known to the animals that can compare with it either qualitatively or quantitatively. The spoken word, thanks to the entire preceding life of the adult man, is connected with all external and internal stimulations that reach the cerebral hemispheres, it signals them all, it replaces them all and can, therefore, produce those actions, those reactions of the organism that are conditioned by the stimuli."

Pavlov's teachings enable us to get a more profound understanding of Engels' assertion concerning the important role played by articulate speech, side by side with work, in the life of man and of its effect on his organism. The brain and the sensory organs were transformed under the combined action of work and speech, they acquired new qualities and perfection in the progressive unification of vital processes in the human body.

Brain specialists are able to give a fairly precise localization to speech functions, especially by their study of the microstructure of the cerebral cortex. The Institute of the Brain (Academy of Medical Sciences of the U.S.S.R.), has conducted detailed investigations of the frontal lobes (Y.P. Kononova), the inferior parietal region (Y.G. Shevchenko), the temporal region (S.M. Blinkov), the ontogenesis of the cortex (G.I. Polyakov), the occipital region (I.N. Filimonov) and the thalamus

(M.M. Kurepina). Another important study is that of the vascular system of the cortex carried out by B.N. Klosovsky (1954) at the Institute of Pediatry (Academy of Medical Sciences of the U.S.S.R.).

The investigation of the sound producing apparatus, the speech organs, is of interest in addition to the study of the brain cortex and its close relation to speech functions. During recent years a number of works have appeared, both anatomical and anthropological, on the larynx. The work of V.V. Bunak (1951) who has studied the laryngeal structure in man and the apes in connection with the development of speech (see also the work of E.N. Khrisanfova, 1956) is worthy of attention.

The investigations listed above are important to the understanding of the evolution, functions and structure of the human brain and of the development of speech and thought. According to Pavlov, speech and man's thinking capacity are intimately connected. In 1932 he wrote about "that addition that must be accepted to obtain a general impression of higher nervous activity in man. This addition concerns the speech functions that introduce a new principle into the activity of the cerebral hemispheres. If our senses and impressions of the surrounding world represent our first, concrete signals of reality, then speech, especially primary kinaesthetic irritations that reach the brain from the organs of speech, constitutes a second signalling system, the signals of signals. They are a digression from reality and allow generalization; these features constitute our additional, *specifically human higher thought process....*"

It would be difficult to overestimate the significance that this Pavlovian postulate has for the science of man and his mind.

Soviet anthropologists must increase their planned investigation of the anatomical and physiological peculiarities of man as compared with the apes, monkeys and other mammals that are most important in the study of evolution. First and foremost this concerns the brain, the afferent nerves, the speech apparatus and the hands, the anthropological study of which must concern the adaptation of the human body to erect locomotion, work, and speech functions, as seen in man's ontogenic and phylogenic development.

The great similarity of the anatomical and physiological features of the human and simian brain and sensory organs due to their close phylogenic relationship, permits us to seek noticeable similarity in their higher nervous activity despite the fact that it is here that the difference is particularly great because it has been conditioned by the specific path of development taken by human consciousness.

In order to discover how man's specific labour activities could have been initiated we must turn, in particular, to its fountain head in the palaeobiology of the Upper Tertiary anthropoids. The ancestors of man were among these anthropoid apes and primordial forms of work activity must have developed there.

Since man is very closely related to the apes it is there that one must seek suggestions of the primitive forms of human labour.

Some conception of the way in which our ancestors went over to the use of tools may be had by studying the behaviour of apes under artificial experimental conditions. The numerous observations and experiments conducted by Soviet scientists have shown that the apes, when placed in a position in which they could not obtain food with their hands have proved capable of making adequate use of sticks and other objects to obtain it.

In drawing a parallel between the type of behaviour exhibited by the apes and man, in defining the similarity and differences between them, we must emphasize that the behaviour of modern man is primarily conditioned by the influences of his social surroundings. It is essential to take into consideration the profound qualitative distinctiveness of human behaviour. Attention must also be drawn to the radical difference between the behaviour of modern man and that of the other animals since it is due to differences in the nature of their thought processes.

The behaviour of the apes must not be judged as that of individuals. These animals live, as a rule, in herds, and their behaviour to a very considerable extent reflects the influence of the gregarious way of life and this is important for the understanding of anthropogenesis. One cannot, of course, conceive of labour in the form that is characteristic of man alone, i.e., in the form of social activity, having been initiated by apes that did not live in herds.

A great part in the development of consciousness must be ascribed to social surroundings with their powerful influence on the processes of interaction between developing labour, and developing brain and speech. To get an idea of how social habits developed among the earliest men we must examine manifestations of the herd instinct among the Primates.

CHAPTER THREE

THE HERD INSTINCT IN MONKEYS AND RUDIMENTARY FORMS OF LABOUR

1. THE HERD INSTINCT IN MONKEYS

The herd instinct is met with quite frequently among the higher Primates. The lemurs and monkeys live mostly in groups. The tree-shrews (Tupaiidae), closely related to the lemurs (figs. 80-82), usually live singly or in pairs. Some of the lemurs form small groups of six to twelve (for example, the Lemur catta L. [ring-tailed] and Lemur macaco L. [black lemur]); others, like the ruffed Lemur variegatus Kerr, live in big troops; a third group, like the lorises and galagos, live in pairs or in families while the dwarf lemurs (Chirogaleus E. Geoffroy), pottos (Perodicticus Bennett) and mouse lemurs (Microcebus E. Geoffroy) live singly. The tarsiers live mostly in pairs (see summary given by S. Zuckerman, 1932).

Some of the American marmosets (Hapalidae) such as the tufted-eared marmoset (Hapale Illiger) and more particularly the common marmoset (Hapale jacchus L.) live in small groups up to six individuals as do the maned tamarins or lion marmosets (Leontocebus Wagner); others live in pairs or individually.

Of the Cebidae family (figs. 83-85) the owl-faced monkeys or durukuli (Aotus trivirgatus Humboldt), apparently live in very small groups or pairs in the same way as the titi monkeys (Callicebus Thomas), sakis (Pithecia Desmarest et Chiropotes Lesson), ouakaris (Cacajao Lesson) and woolly monkeys (Lagothrix E. Geoffroy).

A group of capuchin monkeys, usually of 10 to 12 members (the males also live by themselves) sometimes join herds of squirrel or "death's head" monkeys (Saimiri Voigt) of 50 to 100 members. They also attach themselves to herds of coatas or spider monkeys that number from 30 to 40 black-faced (Ateles ater F. Cuvier) and up to 100 red-faced spider monkeys (Ateles paniscus E. Geoffroy). Other types of spider monkeys live in smaller groups of from 10 to 20 members.

Fig. 80. Tupaias:

1—common tree-shrew (Tupaia glis Diard), habitat: India, Indo-China, Malay Archipelago; *2*—the pen-tailed tree-shrew (Ptilocercus lowii Gray), habitat: Malacca, Borneo, Sumatra, Banka. After H. Osborn, 1918 (*1*) and after W. Gregory, 1929 (*2*).

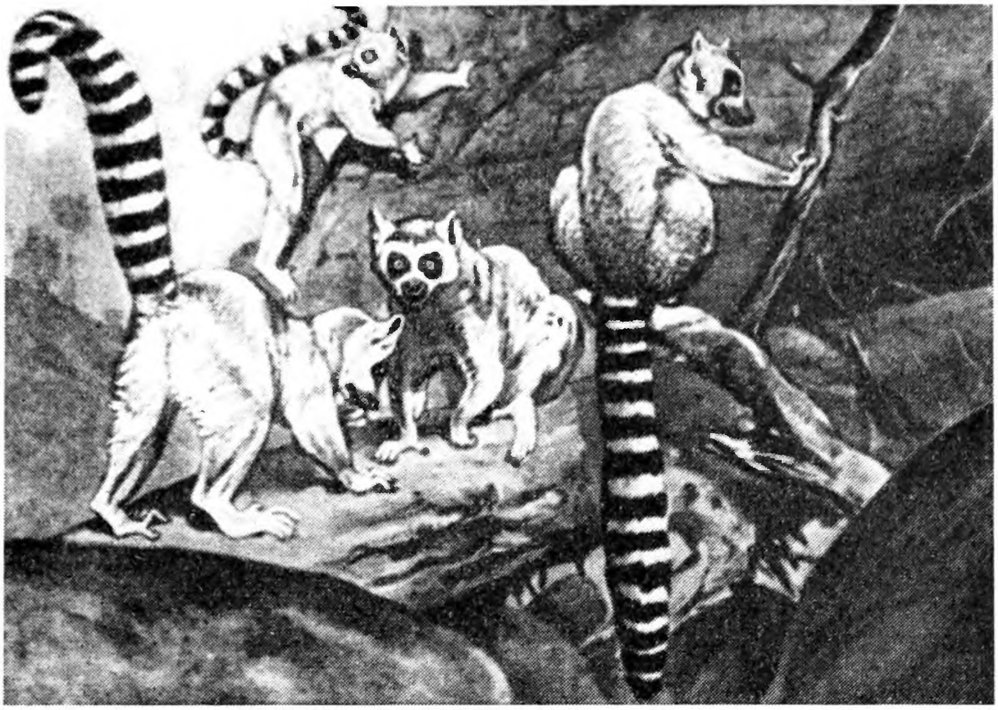


Fig. 81. Group of ring-tailed lemurs (Lemur catta L.).
After H. Klaatsch, 1915.

Fig. 82. Herd of sifakas (Propithecus verreauxi A. Grandidier), habitat: South Madagascar.
After G. Grandidier and G. Petit

Fig. 83. Owl-faced monkey or durukuli (Aotus trivirgatus Humboldt), habitat: Eastern Brazil.
After A. Brehm, 1904.

Fig. 84. Squirrel monkeys (Saimiri sciureus L.), habitat: Brazil, Guiana.
Archives of Moscow Museum of Anthropology.

Very interesting observations of the herd instinct in red-faced spider monkeys were made in 1932-1933 by C.P. Carpenter (1935) in the Province of Cotto on the frontier between Panama and Costa Rica.

In the primeval forests along the Rio de la Vaca there are large numbers of red-faced spider monkeys. They live in herds of as many as 32 individuals. During the day they search for food moving through the trees while the youngsters frolic. At dusk the herd settles down for the night in a tree that is convenient for the purpose. The monkeys wake up very early, before dawn.

The spider monkeys live almost exclusively on fruit and nuts and feed twice a day: their chief meal is eaten in the morning, approximately from dawn to 10 a.m., the second in the afternoon. In their search for food they wander about within the limits of a more or less definite forest area. When moving along the branches the spider monkeys hold their long, prehensile tails over their backs but when they pass from branch to branch they also use them as a fifth organ for grasping and climbing. Their method of locomotion is similar to the brachiation of the gibbons as they hold on to a branch by their hands (and tails) with the trunk in a vertical position.

Fig. 85. Scarlet-faced or white ouakari (Cacajao rubicundus s. calvus J. Geoffroy), habitat: Eastern Brazil, Guiana.
After S. Zuckerman, 1933.

Fig. 86. Mantled howling monkey. (Alouatta palliata Gray) adult female
After C. Carpenter, 1934.

The herd of spider monkeys often breaks up into groups that live independently for a day or a week and then join up to form a herd again. These smaller groups vary in composition. Carpenter noted the following combinations: 1) a female with one, two or more youngsters; 2) several females with their offspring; 3) one male or several males with a much larger number of females and their offspring; 4) males alone (up to 10 individuals of various ages from youngsters up to aged monkeys.)

As they wander about the woods the groups keep in touch by vocal sounds, calling to each other from time to time. Occasionally they approach close enough to see each other.

The females of the red spider monkey are apparently capable of reproduction throughout the year which explains, in particular, the presence of youngsters of all ages in the herd. At the same time definite periods of sexual activity have been noticed among the females, something in the nature of a "heat" period.

For about a month after birth the young monkey clings to its mother's belly after which it is carried on her back with its tail grasping the root of its mother's and its hands and feet fastened in her fur. The mothers frequently rid the coats of their offspring of parasites and thorns. Less frequently the monkeys clean each other's coats.

Fig. 87. Group of grey-green monkeys (Cercopithecus griseoviridis Desmarest = C. sabaeus L.) in tropical jungle.

After A. Brehm, 1904.

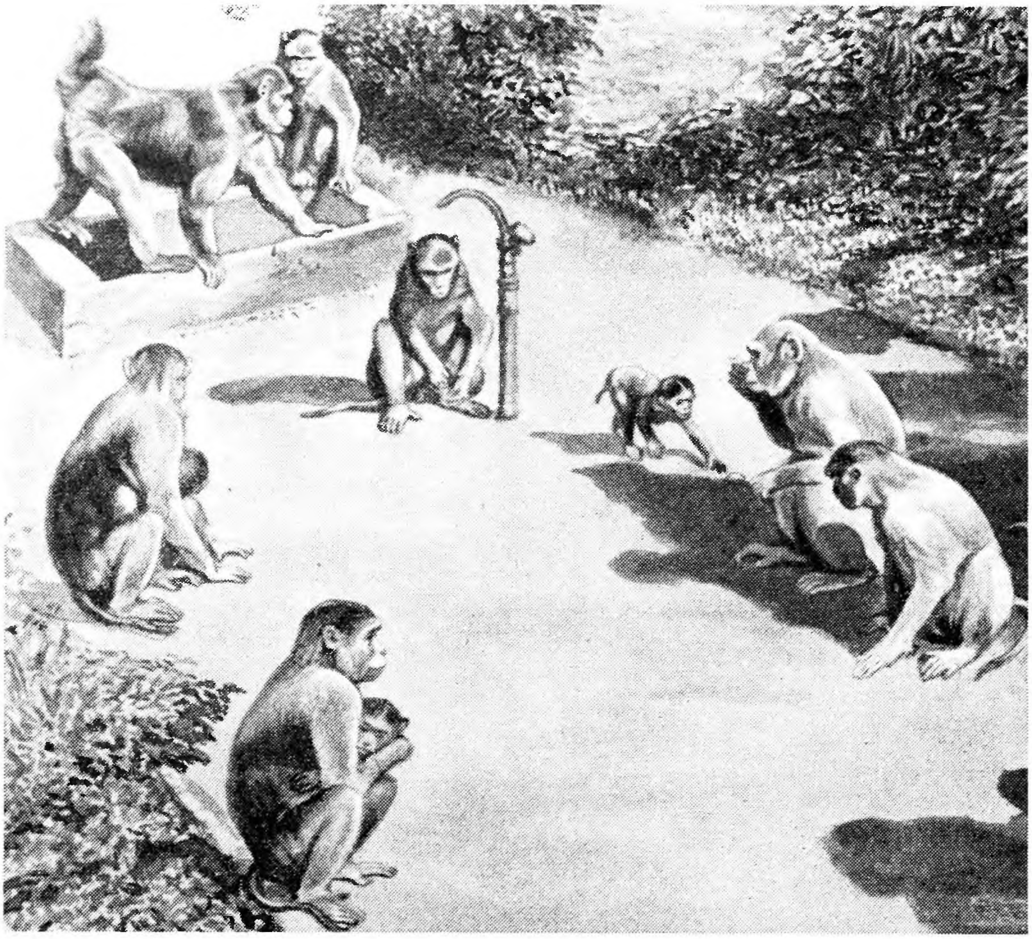


Fig. 88. Group of rhesus monkeys (Macacus rhesus Audebert = Macaca mulatta Zimmermann).
Institute of Experimental Patholcgy, Academy of Medical Sciences, Sukhumi.

Play has been observed only amongst the youngsters. Carpenter reported that young spider monkeys chase one another for hours and that their games consist of running, leaping from branch to branch or up and down in one place and hanging from branches by their tails and extremities; they also play with twigs and other objects. Very young animals also play with their own feet and tails. During their play they catch one another and bite playfully. Tussles and struggles, even when the monkeys are hanging by their tails, constitute an important feature of their play, as many as four animals participating in such a game.

Carpenter observed several battles between males. Some males that had been killed by hunters had scars on their hands, shoulders and heads and some of them had torn ears. It seems, however, that serious battles between them are not frequent. They may possibly occur on account of the females, although there are generally more females than males in a herd of spider monkeys. Altogether Carpenter studied 181 individuals; of these 46 were males and 76 females (22 of the latter

Fig. 89. Herd of mantled baboons (Papio Hamadryas) amongst rocks, Ethiopia.
Fresco by V. Samoilenko-Mashkovtseva. Museum of Anthropology, Moscow State University.

being mothers with offspring), 37 young animals and 22 infants still with their mothers.

Some of the woolly monkeys live in groups up to 14 in number while others, such as the brown woolly monkeys (Lagothrix infumata Spix) live in pairs. According to E. Bartlett (1871) several pairs may live in one tree. Groups of them are sometimes mixed with other species of capuchin monkey. Lastly, the howling monkeys (Alouatta Lacépède) usually live in small herds in which there are normally more females than males, as is the case with the spider monkeys. Other howling monkeys live in pairs or in small groups of 5 or 6.

Carpenter's observations (1934) of mantled howling monkeys (Alouatta palliata Gray) (fig. 86) on the island of Barro Colorado (Central America) showed that they live in groups of 4 to 29-35 individuals, the average herd being 17 or 18 animals. The ratio of males to females was 27:72.

Carpenter noted in particular that when a female is sexually active several males will copulate with her in turn without any signs of jealousy. No quarrelling or rivalry between males for the leadership of the group or in its defence from enemies was noted between the males of a single group or clan.

Carpenter also reported that the howling monkeys make use of nine different vocal signals that are either expressions of emotions or signals warning of danger. There were also several sounds whose significance could not be ascertained.

The herd instinct is somewhat more strongly expressed in the lower catarrhine monkeys (S. Zuckerman, 1932). Firstly, let us examine the Cercopithecine group of guenon monkeys. The green vervet monkey (Cercopithecus pygerythrus F. Cuvier) lives in groups from 12 to 100 members. The grey-green guenon, the Grivet (C-us griseo-viridis Desmarest) forms groups from 5 to 30 animals. The common green guenon (C-us sabaeus L.) lives in herds up to 50 strong. All these species of monkey, however, may form large herds or may live in small family groups. The same vervet green monkey is met with in some places in large herds, in others in small family groups, in pairs and by itself. Apparently, the family groups may unite to form a herd that is not always stable. In each herd or family group there is a leader, the biggest, strongest and most bad-tempered male.

Little is known about the mangabeys (Cercocebus E. Geoffroy) who seem to live in small groups of 5 or 6, and are also found in pairs.

The macaque herd is built up on the principle of each male retaining for himself as many females as possible. Small groups sometimes unite to form a herd.

The tailless macaque or Barbary ape (Macaca sylvana L. Inuus ecaudatus E. Geoffroy) lives in small family groups. The rhesus macaque (M. mulatta Zimmermann) lives in bigger herds (fig. 88). The Formosan macaques (M. cyclopis Swinhoe), the common or crab-eating (M. irus

F. Cuvier) and the lion-tailed (M. silenus L.) live in herds of 12 to 20 or more animals. The pigtailed macaque (M. namestrina L.) is found in larger herds.

The tufted Celebes baboon or black ape (Cynopithecus niger Desmarest) that is similar to the macaque monkeys, lives in pairs or small family groups containing up to 8 individuals. The baboons proper (Papio Müller) have a more highly expressed herd instinct than any other monkey (fig. 89). Although some of them live in small groups, as a general rule they form big troops of dozens and even hundreds of animals. The Ethiopian Anubis baboon (Papio doguera Pucheran) forms herds up to 100 or 200 animals and the mantled baboons (Papio hamadryas L.) form herds of 300 or more; in the vicinity of Mount Kilimanjaro (Kenya), however, these animals are found in small groups of 14 to 20, like the yellow baboons (Papio cynocephalus L.). Somewhat larger than the last-named are the herds of gelada apes (Theropithecus Is. Geoffroy) living in South and Central Ethiopia (fig. 90). Lastly, the gigantic South-African baboon or chakma (fig. 91) lives in huge herds of several hundred members.

Fig. 90. Gelada ape (Theropithecus gelada Rüppell), habitat: Ethiopia.
Photo by Sukhumi Medico-Biological Station.

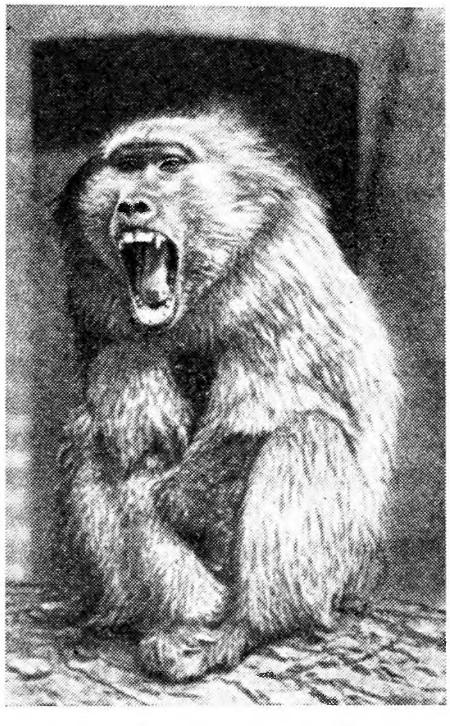


Fig. 91. Chakma baboon (Papio porcarius Brunnich), habitat: South Africa.
After S. Zuckerman, 1933.

The basic herd unit of the baboons is the family group; this is noted not only by observation of their common gregarious habits. When a herd of baboons is pursued it breaks up into separate family groups

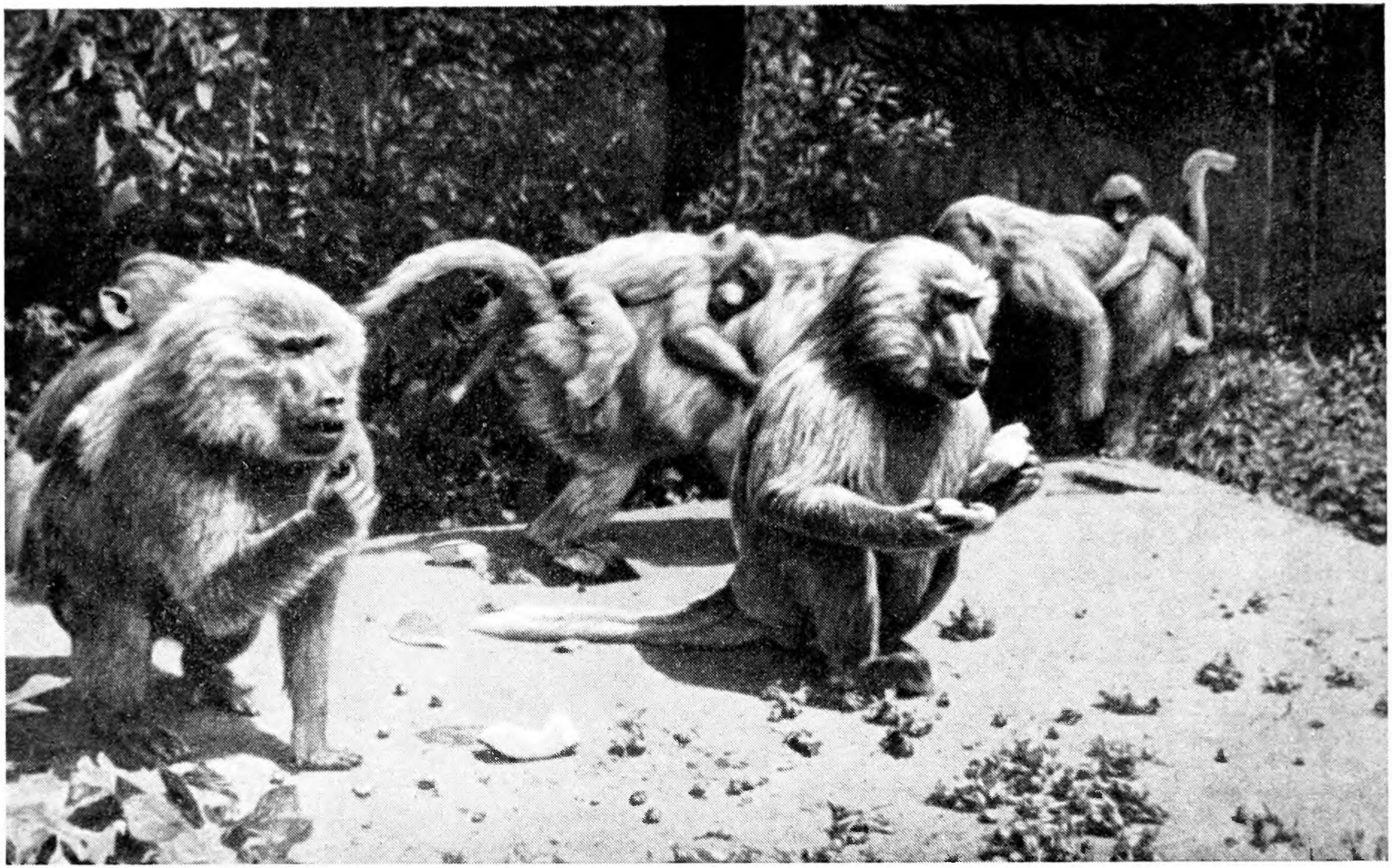


Fig. 92. Mantled baboons in open-air cage. Sukhumi Medico-Biological Station.

and these, like the unpaired males, flee independently. Somewhere in a safe place, amongst impregnable rocks, the herd gathers again. The family group may contain another male who submits to the leader but does not enter into sex relations with the females.

Some valuable observations of the herd instinct in mantled baboons (figs. 92-93) have been made by N.Y. Voitonis, Nina Tikh and other scientists at the laboratory studying the development of higher nervous activity at the Sukhumi Medico-Biological Station (Academy of Medical Sciences of the U.S.S.R.). The main conclusion drawn by Nina Tikh from her observations (1950) was: "The most important moment achieved by the apes in the development of the herd instinct is that their *herd relations, while retaining their biological significance for the preservation of the species, extend beyond the bounds of direct dependence on sexual, food and defence impulses and become an independent necessity.*"

The following qualities are of importance to the monkeys: highly developed nervous system, receptors and muscular apparatus, unusual rapidity and lability of perception, a well developed memory and a great ability to acquire individual experience and of mimicry. These are the features that determined the development, in the immediate

Fig. 93. Mantled baboons. Females with young. Sukhumi Medico-Biological Station.

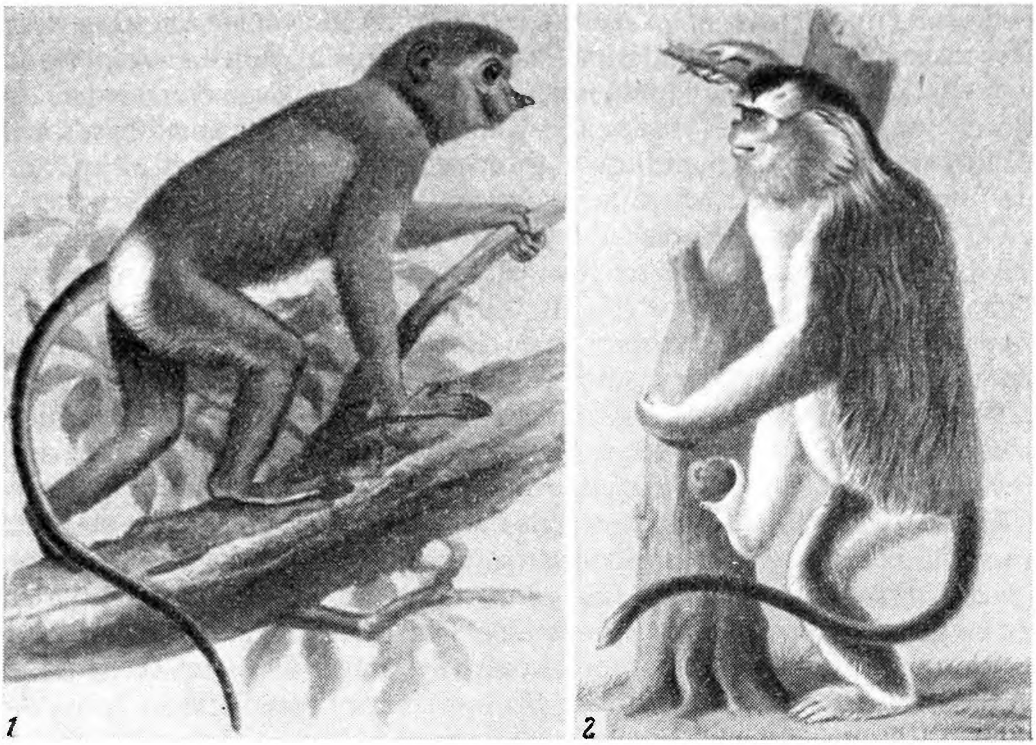


Fig. 94. Proboscis monkeys:
1—proboscis monkey or kahau (Simia nasica F. Cuvier = Nasalis larvatus Wurmb), young female, habitat: Borneo; *2*—snub-nosed golden monkey (Rhinopithecus roxellanae Milne-Edwards), habitat: Tibet, Western China. After A. Brehm, 1904 (*1*), and after F. Cuvier and E. Geoffroy, 1815 (*2*).

precursors of man, intricate and specially formed higher nervous activity, the inception of social labour and, later, of speech.

Semnopithecinae, lower catarrhine leaf monkeys, live mostly in herds, frequently of 6 to 12 members and never more than 30. Such species as the Barbian langur (Semnopithecus or Presbytis barbei Pocock) form bigger herds, up to 50 members. The entellus langur (S. entellus Dufresne), the sacred monkey of the Hindus, lives in herds of 100 or more. The priests of one temple in Benares maintained about 200 of these monkeys. Zuckerman (1932) reports that in several parts of India large herds of these monkeys are to be seen on the banks of the rivers, in the trees, in the vicinity of villages and on the roofs of village houses. The langur herd consists of numerous family groups. The proboscis monkey or kahau that is found only in Borneo (fig. 94) has been seen in herds of about 40; the same applies to the African guerezas (Colobus Illiger).

From what has been said about the herd instinct in the lower monkeys we may draw the conclusion that only a small number of them live in pairs and that the majority live in small groups or in large herds of several dozen animals. Lastly, some of the arboreal monkeys such

as the Semnopitheci and such terrestrial monkeys as the doguera, hamadryas and chakma baboons form huge herds of which an important structural element is the family unit consisting of a male and one or two or more females with their babies and young offspring. The small herds are usually nothing more than family groups. Male individuals of all species are found living alone when they have not yet acquired female partners.

Of the apes, some of the gibbons, for example, the hoolock gibbon (Hylobates hoolock Harlan) live in herds. The others, such as the white-handed gibbon or lar (H. lar L.) live in small groups of not more than 20. Groups of lar gibbon males form separate "bachelor clubs." Complete data on the family life of gibbons are not available. According to Ch. B. Kloss (1908) they live in pairs. I.G. Sanderson and G. Steinbacher (1957) have also recently subscribed to this opinion. Zuckerman, however, concedes that one male may live with several females.

The orangutans (Pongo Lacépède) are much less gregarious and are usually found in small family groups. The male is even found living apart from the female and her young, but the family, apparently, is an integral and permanent formation. The herd instinct is manifested by young orangutans who join company and travel for some time together, after which they divide up into pairs (fig. 95). It is very difficult to observe the orangutan in its natural habitat, the tropical forest

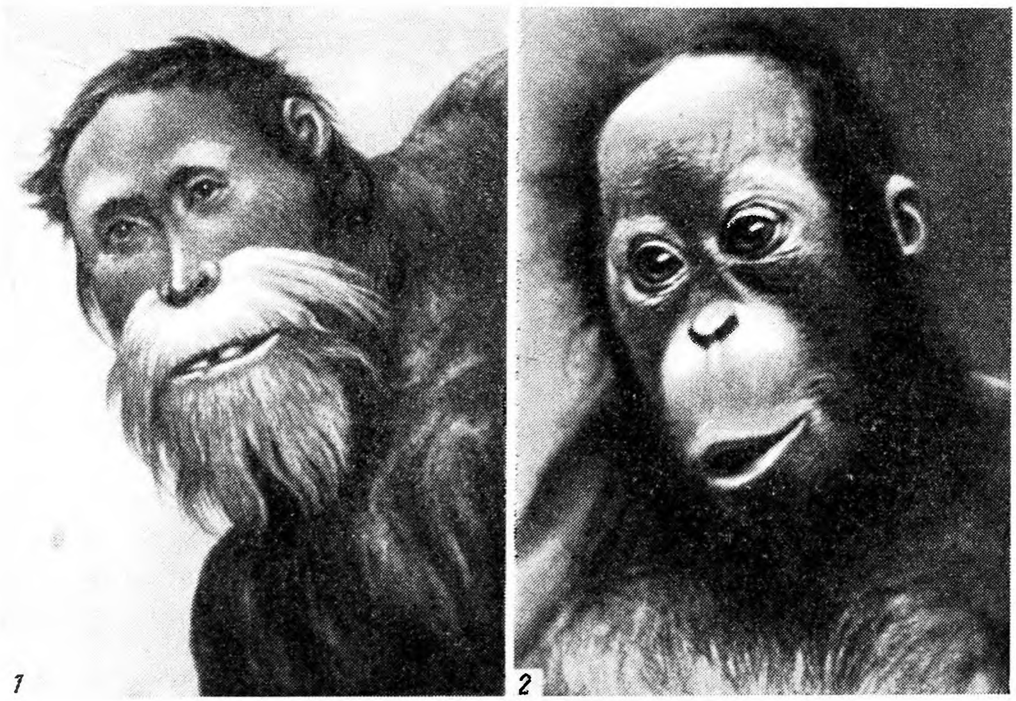


Fig. 95. Orangutans.

1—young male, 5 years; *2*—young female. Archives of Institute of Anthropology, Moscow State University (*1*) and from Dr. S. Voronov's monkey nursery at Menton, France (*2*).

with a swampy floor. V.E. Shelford (1916) expressed the opinion that until people acquire the habit of tree climbing, it will be impossible to discover whether the orangutans live in pairs or whether the male lives with several females (A. R. Wallace, 1872).

The greatest African ape, the gorilla (Gorilla Oken) usually lives in small groups (fig. 96) of one or several families.

Family groups consisting of one male, one female and their young are met with, but usually the male is accompanied by several females (up to six).

On account of this, adult males are often found living alone. The gorilla herd varies from 4 to 20-30 and, in rare cases, as many as 40. The herds of mountain gorillas are larger than those of the coast gorillas (Carl Akeley, 1929).

Alliances of gorillas in big groups of 30 to 40 are of a temporary character. It is reported that family groups of mountain apes (Gorilla gorilla beringei Matschie), after spending the day in search of food, may gather together in the evening. It will be remembered that the great anthropoid apes build nests in the trees in which to spend the night while other monkeys do not. The gorillas, however, especially the big males, frequently build their nests on the ground for one night only. Nest building is an inherent, complicated, unconditioned reflex.

Information on the life of the mountain gorillas at liberty is to be obtained primarily from a monograph by Harold C. Bingham (1932). He spent two months making a special study of them in September and October 1929 in the game reserve of the Albert National Park to the north of Lake Kivu in the Belgian Congo (reserve founded in March 1922). The gorillas there live on the slopes of the extinct volcanoes Mikeno, Karasimbi, Visoki, Sabinio, Gehu and others up to 4,000 metres in height. They live in the tropical growths that cover the lower slopes; they are also found higher up the mountains where the soil is composed of the products of volcanic eruptions. Bamboo is an important plant in these parts and its young shoots constitute one of the favourite foods of the gorillas.

In the lower zone, at a height of about 2,300 metres, the gorillas build nests both on the ground and in the trees, but higher up they spend the night on the ground, choosing for their nests places that are protected from the cold winds and rains. Bingham studied altogether 500 nests; in one place he saw 38 nests of various sizes all at once, 12 of them in the trees. Two nests had been skilfully built on the tops of the bamboo; in one case 10, and in another 12 trees had been used in building a nest; the tops of them had been bent and their branches interlaced so that the foliage with the thinner twigs formed a nest. The nests are usually built at a height of 3 to 18 metres.

In the day-time, while eating or resting the gorillas make similar nests, or resting-places, which Bingham named conditionally day-time nests. These ground nests the gorillas may also use as sleeping-places

at night. The methods of building night nests vary greatly, depending on the nature of the locality, the weather, the vegetation and the age of the animal concerned. Sometimes the nests are built under a big tree or, more rarely, under the shelter of an overhanging rock.

In the high mountain areas the nests are frequently made by breaking young, brittle trees and forming them into a framework on the bottom of which leaves from the bigger trees are placed. In the lower zone many nests are built in trees, in the forks of branches, by breaking, bending and interlacing the thinner branches. The animal sits or stands in the middle of the future nest and, when it has built the framework, lines it with leaves. If the nest proves unstable the gorilla smashes it and builds a new one or goes to another place and builds a fresh nest there.

During the day the gorillas move about the forest in search of food. They may wander for several days or even several weeks and then return to their original starting-place. An area that abounds in food is frequently chosen for the day-time and sometimes also for the night's rest. In the course of their travels the gorillas cross streams.

The gorilla eats succulent vegetable foods and has little need of water, especially as water collects in the hollows of some big leaves after rain. Among the plants and their parts used by the gorillas as food, Bingham mentions the hearts of wild celery, banana stalks, wild parsnips, various tree fruits, juicy black cherries, the juicy young stems of green lobelia and young bamboo shoots. Animal food (insects, the honey of wild bees, birds' eggs and fledgelings) is only used by way of exception. Apparently the gorillas very seldom climb trees for food.

Bingham managed to make a number of interesting observations, although they were, unfortunately, very brief. He noted gorillas living alone, in pairs, in family groups of 5 or 6, in herds of 10-25 and even in herds of 30 or 40 individuals.

It was very difficult to observe the gorillas and photograph them in the dense vegetation. It was rarely possible even to get within 30 metres of the gorillas. In some cases the gorillas noticed that they were being watched, but remained indifferent to the presence of people who, of course, exercised care and kept hidden as far as possible.

Bingham heard the gorillas produce various noises—grunts, barking, whining, snorting and roaring. The sounds they make by beating their breasts with their fists are of a special character. The leader of the herd is a big male, quite frequently with grey hair on his back and loins. When they sensed people in their vicinity the males made various sounds in chorus expressing anxiety while the other members of the herd kept calm. When they beat their breasts the males raised their elbows.

In general gorillas are less mobile and playful than chimpanzees. When they are on the ground, gorillas usually move on all fours, but they sometimes take a few steps on their hind limbs, beating their breasts as they go.

Bingham describes the presence of leaders in herds of gorillas. In one

Fig. 96. Herd of mountain apes (Gotilla gorilla beringei).
Fresco by Y. Samoilenko-Mashkovtseva, Museum of Anthropology, Moscow State University.

instance, a male with a grey coat realized that he was being watched and made every effort to slip quietly away with the eight members of his group. In another case, wrote Bingham, the leader of quite a large herd, twenty-two gorillas, tried to approach the watchers unnoticed in an effort to ensure the security of his herd; he did not attack the people, but merely kept them under observation.

The first successful photographs of gorillas in their natural habitat were made by Mrs. Broughton in 1932. She observed the life of mountain gorillas in deep thickets, trying to get as close as possible to them which, at times, was not without danger. The gorillas were exceedingly wary. One male, seeing the people in the thicket, tried to get behind and attack them from the rear. With the aid of a telescopic lens Mrs. Broughton succeeded in photographing young gorillas in a ground nest. One female was startled by the click of the camera and climbed up a tree to find out where the noise came from; she was also photographed.

Chimpanzees (Pan Oken) live in small herds that sometimes join forces. The family, like that of the gorillas, is polygamous, there being several females to each male, as Garner noted in his observation of chimpanzees and other monkeys in the African thickets (1892).

Henry Nissen (1931) made some valuable observations of the life of chimpanzees at liberty in French Guinea; he was working at Kindia, near the Pastoria Laboratory of the Parisian Pasteur Institute, where there is a railway connecting it with the port of Konakri. He observed the life of various herds of chimpanzees (fig. 97) in tropical thickets for 62 days in the dry season. He describes the way in which these apes spend their day.

The chimpanzees begin moving in their nests before daybreak. They are awakened by hunger and start out through the forest in search of food. By 10 or 11 o'clock the chimpanzees are down on the ground again and rest in their nests in the shade of bushes or trees. In general, the chimpanzees avoid the direct rays of the sun, especially at midday. During their journeys in the forest they play, run about and rest mainly in shady places.

Games are played by the younger members and consist of chasing each other, playful but furious struggles with howls and screams, sometimes accompanied by a fearful noise when the chimpanzees hammer on the tree trunks with the palms of their hands and the soles of their feet. In the course of a day the herds travels 7-10 km. within their own area. Towards evening they eat again. They do not reject sour fruits or even those that, to our taste, are bitter.

The chimpanzees have extremely keen sight. They notice when they are being watched from a distance of almost a thousand yards, hurry to hide, running along the ground on all fours and with the aid of their arms moving through the tree-tops to reach the densest thickets. In the evening, before sunset, the chimpanzees make their nests, building at heights varying from 2 to 16 metres (average height—5 to $5^1/_2$ m.). The

chimpanzees make separate nests for themselves. Nissen says that chimpanzee nests are a typical element of the tropical landscape in those places where they live.

One observer noted 11 nests in one tree. The young were in nests together with the adults. The nests were clean and free from excrement. Judging by the undigested seeds and other components of the excrement, Nissen found that chimpanzees eat over 30 varieties of plant.

The chimpanzee herd consists of 8-9 individuals (minimum 5, maximum 14), and is not a regular family group since there are, in many cases, at least two mature males. Nissen believes that a male and female in the chimpanzee herd may not be even temporarily connected by a strictly limited marital alliance. It is, however, extremely difficult to observe sexual and other relations between chimpanzees in their natural habitat and he hesitates to draw definite conclusions.

The development of the herd instinct in apes and monkeys, in addition to such biological moments as the search for food and defence from enemies, is also favoured by the circumstance that both the male and the female can reproduce throughout the year. The menstrual or oestrous cycles are regular and the females of many species of catarrhine monkeys experience a discharge of mucous and blood. Some of them develop big menstrual pads ("sex skin"), for example, the various macaque monkeys, the mangabeys and baboons (P. V. Bochkaryov, 1935; M. F. Nesturkh, 1946; L. V. Alexeyeva, 1949; L. V. Alexeyeva and M. F. Nesturkh, 1958). The cycles follow each other regularly every 30 to 35 days. According to Zuckerman's data the average menstrual cycle in female chimpanzees is 36 days, gorillas about 45 days, orangutans 32 days, lower catarrhine monkeys from 31 to 42 days. In women the cycle varies from 27 to 29 days (data for Primates cf. J. Harms, 1956).

Newborn monkeys are to be seen at all times of the year, although some seasonal effect on the intensity of propagation has been established for certain species, the mantled baboons, for example. It is interesting that the absence of seasonal sex cycles is also noted among tarsiers, lorises and tupaias who appear to closely resemble the monkeys in this point; the Madagascar lemurs, however, like the majority of mammals, have seasonal oestrous cycles.

Information on the oestrous cycle in chimpanzees is given by Yerkes and Elder (1936). They made 158 observations of female chimpanzees and established the average length of the cycle at 36.2 days with a minimum of 23.8 and a maximum of 44.4 days. In this period there is the sequence of menstruation, the development of menstrual pads, ovulation and a period of heat. Females that had formerly given birth to young only permitted the attention of the males during the period when the menstrual pads had developed, that is, when ovulation, or the bursting of the ripe egg from the ovarian follicle, takes place.

Zuckerman, on the basis of his observation of the sex life of baboons, attaches too much importance to sex attraction in the formation of

Fig. 97. Herd of common chimpanzees (Pan Chimpanse).
Fresco by Y. Samoilenko-Mashkovtseva. Museum of Anthropology, Moscow State University.

monkey herd groups. Not all monkeys, however, have such a well-defined sex element as the baboons whose life he has studied both in captivity and at liberty. Zuckerman himself says that the merging of family groups of monkeys into a herd is often brought about by the search for food.

It has been firmly established that female monkeys, as a rule, are not met with alone, but always in the company of a male. In general, it has frequently been observed that male monkeys cohabit with the same females for long periods, sometimes for years. Parallel to the family union of the sexes there are, in the monkey herd, symptoms of unregulated sex relations that outwardly resemble the promiscuity which, it is assumed, was typical of man's immediate ancestors and of the earlier hominids. It is possible that in the herd life of modern monkeys, including some of anthropoid apes, we may get a glimpse, albeit a limited one, of the life of our ancestors, the Late Tertiary apes.

Most likely our ancestors were gregarious apes with strongly developed sex instincts and that sex relations were of a casual and irregular nature. According to Gerrit Miller (1926) such relations are widespread among the lower and higher Old World monkeys and apes. He considers that life in loosely organized herds is the general rule among gibbons, baboons, macaques, guenons and even among the leaf-monkeys. Apparently the same is true of the great apes. Miller says that the same general laws of promiscuous sexual life must be applied to all of them as those observed by G. W. Hamilton among macaques that had been brought to Montecito, near Santa Barbara in California, and let loose in the oak groves there.

Miller, however, goes too far in drawing the conclusion that if man's sex behaviour be examined for what it is and not what conventional restrictions have made it, it would not be difficult to find undoubted signs of herd promiscuity under the surface of the social structure. Present-day social conditions and the relations between people, including family and sex relations, differ qualitatively from those that are typical of a herd of mammals, monkeys and apes included.

In the discussion of such intricate problems the idea expressed by Engels in his *The Origin of the Family, Private Property and the State* is of great value: "The animal family and primitive human society are incompatible things; primitive man, working his way up out of the animal stage, either knew no family whatsoever, or at the most knew a family that is non-existent among animals."*

The animal family was destroyed during the progressive development of the primeval horde. In the social groups of primitive people, various prohibitive barriers emerged and developed and, after the original stage of promiscuity had been passed, resulted in the system of group marriage that later became the human family.

* Marx, Engels, *Selected Works*, Vol. II, Moscow 1955, p. 196.

2. INCEPTUAL FORMS OF LABOUR

A study of the herd instinct in present-day anthropoid apes shows that it is hardly possible that our ancestors of the Miocene Period lived in big bands. It is possible that the horde became more consolidated when the apes took to terrestrial ways of life, since this would have made it easier for them to cope with such difficulties in open country as the struggle against new enemies, the numerous great cats and other carnivorous animals.

Our ancestors had no special natural means of offence and defence; no sharp claws, no prominent fangs, to say nothing of horns and hoofs—none of the special organs that other mammals use to defend themselves against their enemies. They could hardly have been swift runners (Nesturkh, 1957).

From this it follows, as Darwin stressed, that our ancestors were relatively weak animals. The development of the herd instinct was a favourable factor of no little importance that helped them in the struggle for existence. The herd and social instincts played a tremendous part in the further development from ape to man, the qualitatively specific process of the formation of the earliest and early men who, eventually, developed into men of the modern type.

The scientifically founded idea propounded by Marx and Engels on the priority importance of the social instinct in the development of mankind also found expression in the works of Lenin, who pointed to the significance of the internal structure of groups of pre-men and primitive men. In his *The State and Revolution* Lenin speaks of the "primitive organization of a stick-wielding herd of monkeys, or of primitive man, or of men united in clans."* Thus he marks the stages in the development of social forms up to the transformation of the pre-clan form of the primitive horde of hominids like the Neanderthalers into social groups of such fossil men as the Cro-Magnon people and their descendants.

In distant times, in the Tertiary Period, a progressive development of the anthropoid apes of Southern Asia took place when they were living in herds and had already gone over from arboreal to terrestrial ways of life. The further development of the herd instinct and the perfection of biped gait went on at an ever-increasing rate as our ancestors moved to more open territory. Their fore limbs were relieved of their functions as organs of locomotion and so our ancestors were able to make use of natural objects—sticks and stones—as tools and weapons. The process of transition to elementary forms of labour took place in many herds and not in one alone; some started earlier, others later. The idea of labour activity begun independently in many herds of our ancestors is the logical conclusion to be drawn from Darwin's theory of anthropogenesis and from Engels' whole conception of the process.

* V. I. Lenin, *The State and Revolution*, Moscow 1958, p. 17.

It is, indeed, highly improbable that primitive forms of labour could have been concentrated in one single herd. The very idea that the use of tools could have originated in one herd and then spread to others is as improbable as the idea that one single pair of super-talented ancestors taught mankind the manufacture and use of tools—a quite ridiculous idea that is nothing more than a variation on the Bible theme. Furthermore, it was still not real human labour.

A completely new form of activity involving tools that, like artificial organs, increase the power of the natural organs, was so much out of the ordinary for an animal that it could not have become deep-rooted in a short time. The first people, however, appeared in those herds in which the use of tools to acquire their food had become a typical feature. The new method of food acquisition must have developed and taken firm root in a large number of herds before it became a vital necessity to the species. It can scarcely be possible, however, that the use of tools developed in all the herds of our ancestors. Some of the herds probably never reached the stage of labour activity and became extinct, perhaps after they had for a long period coexisted with herds using tools in which primitive forms of labour had led to the appearance of the first people on Earth, the ape-men or Pithecanthropi (fig. 98).

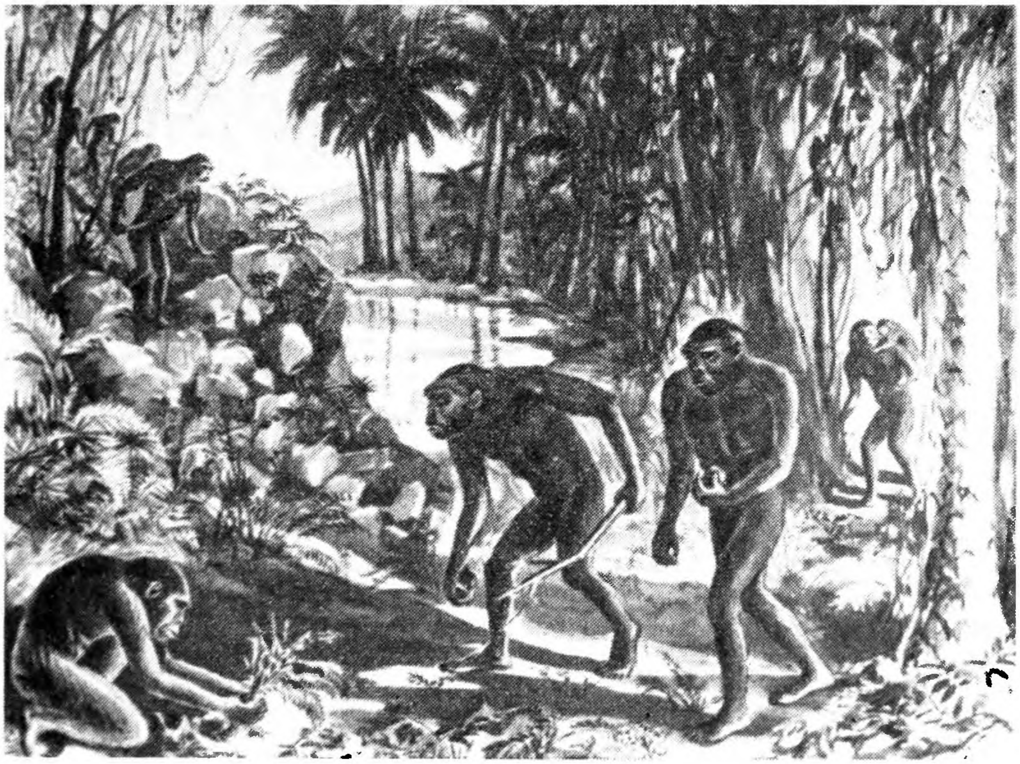


Fig. 98. Pithecanthropus horde.
Drawing by Y. Samoilenko-Mashkovtseva, Moscow Museum of Anthropology.

The transition to erect locomotion, the liberation of the fore limbs from their function of supporting the body, a highly developed brain and a social way of life—these were the most important prerequisites for the inception of labour activity among man's ancestors. At first, of course, the Higher Pliocene anthropoids made use of stones and sticks as tools and weapqns, the necessity of obtaining food and of defence against enemies being the stimuli. Actions that made use of natural objects were, of course, at first instinctive and even when they became a regular feature of life they remained, for a lengthy period, semi-instinctive.

One can well imagine a small group of our ancestors moving from place to place in search of food. From time to time different members of that group or horde pick up stones or sticks that are lying handy to dig up an edible root, kill some small animal or drive off a wild beast. After the transition to erect locomotion, our ancestors, far superior to all other apes in intelligence and adaptability, could not have been content with the use of natural tools; they began to make artificial tools. Labour processes, being biologically advantageous, intensified the ecological adaptation of our ancestors, assumed a mass character in the hordes and brought about the development of new, social laws. In this way the inception of labour, the fabrication of tools and their use by a group of their kind marked the beginning of a new era in the evolution of the animal kingdom; a being had appeared that differed qualitatively from all other animals—man had emerged.

We may assume a series of transitional stages in the development of labour. The earliest men first began to take form as socially working animals. Engels in his analysis of the basic stages of anthropogenesis, speaks of "people in the process of formation" who, as a result of a long period of development, became "ready-made" people when a new element emerged that was of paramount importance for the further history of mankind—a real human society.

The hand, erect locomotion, labour with the aid at first of natural and later of artificial tools, articulate speech, brain and conciousness, the ability to abstract and draw conclusions all took shape in the course of an extremely lengthy period of development, a period of about 900,000 years in which early men, living in a society of their fellows, mutually influenced each other.

There came a sharp increase in the rate of development of man's specific peculiarities during the formative period of a new element, the primitive community that emerged as the above-mentioned elements were perfected, and the primitive human horde in which "ready-made" men had emerged began to disintegrate.

A specific feature of human society that distinguishes it from the ape herd is collective labour with the aid of fabricated tools that had begun in the period of transition from ape to man.

Work activities must be regarded as a boundary line drawn between the fossil apes and the earliest men that were still in the formative stage;

the earliest men, however, possessed the same physical structure, that of the great biped apes, as their brethren in other ancestral herds that had not, at that time, turned to the use of tools.

In the first stages of man's development he possessed a strange combination of simian and human features. Once again, dialectical materialism helps us understand this combination of contradictory elements in the ancient hominids: the first representatives of mankind may have been ape-men in their physical constitution but in their social qualities they were already human beings, although they were at the very lowest stage of development.

It would be incorrect to regard anthropogenesis as a gradual process of evolution without a decisive turning-point, without a leap forward. The process of formation that produced the hominids must not be regarded as the simple development of an ape into a man, it must not be regarded as being merely the quantitative augmentation of some features and the diminution of others.

Such conceptions are anti-dialectic. They are typical of those who strive to minimize the differences between ape and man in order to simplify the concept of transition of the former into the latter. Darwin, too, made this mistake. He said in his *Origin of Species* that nature "can never take a leap."* Although Darwin realized that man is a being qualitatively different from all other animals, he did not appreciate the decisive role of labour and other social factors in anthropogenesis.

The correct conception is to be found in Engels' labour theory of anthropogenesis in which spontaneous development plays an important part. Orthograde locomotion, the foot and the hand, the brain, labour, speech and the social instinct—all these elements of anthropogenesis are intertwined and exert mutual influences. They affect each other intimately and are interdependent and themselves effect changes as society and nature develop. In the course of the long and tortuous process of formation experienced by the hominids, the physical type of modern man emerged with a material and spiritual culture that is immeasurably richer than that of more ancient men, his ancestors and predecessors.

* Cf. Charles Darwin, *The Origin of Species by Means of Natural Selection*, London 1950, Chapter VI, p. 167.

PART THREE

PALAEANTHROPOLOGICAL DATA ON THE MAKING OF MAN

C H A P T E R O N E

THE FIRST STAGE: THE EARLIEST MEN (PITHECANTHROPI)

1. THE JAVA PITHECANTHROPUS

A new stage in the development of nature began with man's appearance early in the Quaternary Period.* In the course of a million years man has developed into a powerful being.

As compared with the whole preceding history of the evolution of the animal kingdom, man has existed for an insignificant period. But his achievements in that period and the extent of his influence on the animal and vegetable kingdoms are tremendous.

Let us recall that as early as the Tertiary Period, at the time when the higher Primates, the apes and monkeys, were developing, the particular line that subsequently led to man was also taking shape. We may suppose that it branched off from the common trunk, together with the ancestors of the gorilla and the chimpanzee, in the Miocene Epoch. After this the ancestral group of anthropoids that was later to bring man into the world developed independently until it had produced the Australopithecus. The first men emerged at the beginning of the Quaternary Period within one of the species of great anthropoid apes of the Australopithecus type.

In the preceding section of man's genealogical tree that lasted throughout the Pliocene Epoch, 11,000,000 years, there are still some big gaps. The gaps are augmented by the fact that the Miocene Epoch of some 8,000,000 years has produced very few fossil remains of our ancestors. The finds of the Ramapithecus, belonging to the Lower Pliocene, and some others, e.g., the Oreopithecus have done much to fill in the gaps.

* Since the emergence and development of man is very typical of the Quaternary Period, A. P. Pavlov suggested calling the system of Quaternary strata anthropogenic and also to give the period the same name "Anthropogen" as being characterized by the presence and activity of man.

The discovery of the Pithecanthropus, combining simian and human physical features, was of outstanding scientific interest. In the eighties of the last century, Professor Eugène Dubois of Amsterdam University (1858-1940), at that time assistant professor of anatomy and military surgeon, saw service on the islands of the Malay Archipelago. He dreamed of finding the fossil remains of man's ancestors. He organized his search on the island of Java and in 1889 found the remains of two skulls belonging to ancient men of the modern type near the village of Wadjak. The crania are very big (1,550 and 1,650 c.c.) and they have pronounced supra-orbital ridges.

At last, in 1891, Dubois managed to find a cranial vault (fig. 99) and a third upper right molar and in 1892 a femur (thigh-bone) and a left upper second premolar (fig. 100) belonging to some ape-like creature. In Dubois' opinion all these remains belonged to one and the same individual. The structural peculiarities of the cranial vault, the greatly

Fig. 99. Cranial vault of Pithecanthropus I (P. erectus Dubois), found in 1891:

1—lateral and *2*—superior aspects. $^1/_3$ natural size. After E. Dubois, 1894.

sloping forehead, the strongly expressed supra-orbital torus and the rather large capacity of the cranium (900 c.c.) led him to conclude that the remains belonged to a being intermediate between ape and man, the missing link in man's genealogy, which, according to the prophecies of Darwin and Haeckel had to be sought in hot countries. Dubois named his find Pithecanthropus erectus, the erect, biped ape-man.

The remains were discovered near the village of Trinil on the banks of the River Bengawan at a depth of about 15 metres in strata that Dubois defined as Lower Quaternary. Later L.J.C. van Es (1931) confirmed the geological age of the Pithecanthropus.

After 1895 a lengthy search was made for other Pithecanthropus remains by Leonore Selenka and M. Blanckenhorn, but without success until 1898 when another Pithecanthropus tooth, a left lower first incisor, was found.

While speaking of the fossil bones of mankind's oldest representatives unearthed on Java, we must mention the fragment of a mandible that Dubois had the good fortune to discover at Kedung-Brubus (Kedoeng Broboes).

The discovery of the Pithecanthropus remains aroused great interest and impassioned disputes among scientists the world over. Many opposed the definition of the remains as those of an intermediate form. Rudolf Virchow (1895) regarded the Pithecanthropus as a giant gibbon or some other big fossil ape. In Virchow's opinion the Pithecanthropus was neither a new genus of hominid nor the long-sought missing intermediate link between man and ape.

Even before the Java finds Virchow had cast doubt on the Neanderthal skulls which he believed to belong to a modern type, pathological in character and deformed while still in the ground.

P. A. Minakov (1923) made an attempt to discredit Dubois' find, ascribing the shape of the skull to considerable posthumous deformation. To prove his point he demineralized a modern skull and then subjected it to pressure getting something like the Java skull in shape and dimensions. In a letter sent to the Moscow Museum of Anthropology in reply to Minakov, the Dutch scientist pointed out that neither the Pithecanthropus cranial vault nor the thousands of animal bone remains found in those same ancient strata had been either demineralized or deformed. If a bone is softened and subjected to mechanical pressure it will, of course, become very pliable and change its shape.

Such attempts to cast doubt on an intermediate link between ape and man are only made by those who do not accept the theory of man's descent from an ape because it undermines faith in the miraculous creation of man by God and thus undermines religion, one of the strongest buttresses of idealist philosophy.

In 1932, Dubois and his assistants, searching through boxes of old material gathered by the 1900 expedition, found four fragments of Pithecanthropus femurs and, later, another fragment (from a sixth

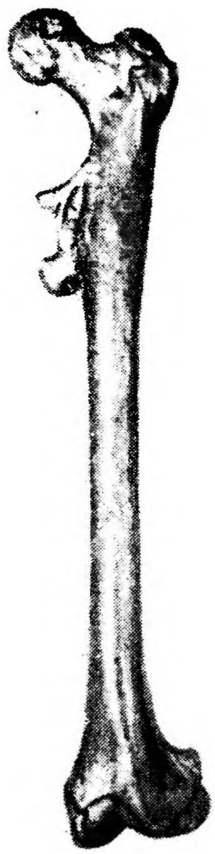


Fig. 100.
Femur (thigh-bone) of Pithecanthropus.
$^1/_5$ natural size. After E. Dubois, 1894.

femur). After a study of these bones Dubois (1933) expressed the opinion that the Pithecanthropus probably led an arboreal life. This opinion, however, is refuted by the majority of scholars since the shape and size of the femur differs little from those of the femur of modern man.

At the same time Dubois published a monograph in which he proved that femur V (one he had specially studied) differs from a human femur in the microstructure of the compact outer part of the bone. N. A. Sinelnikov (1934, 1937), a Soviet anthropologist who had made a special study of the structure of a modern human femur, found the statement that the Pithecanthropus femur had a special structure groundless and that Dubois had been mistaken in regarding the Pithecanthropus as a special species of giant gibbon. The Pithecanthropus is fairly representative of the earliest stage in the evolution of the hominids.

The remarkable thing is that Sinelnikov's investigations and conclusions were fully confirmed by Dubois' later work (1937): he made a study of the direction of the osteons, structural elements in the hard outer casing (substantia compacta) of seven human femurs from Leyden burials dated between 1752 and 1875 and found that their distribution in all the bones was identical with that of the Pithecanthropus femur V. Dubois, therefore, admitted that his earlier conclusion regarding the distribution of osteons in the Pithecanthropus bone had been erroneous. He had previously made use of published data on compacta structure in modern human thigh-bones that proved to be wrong.

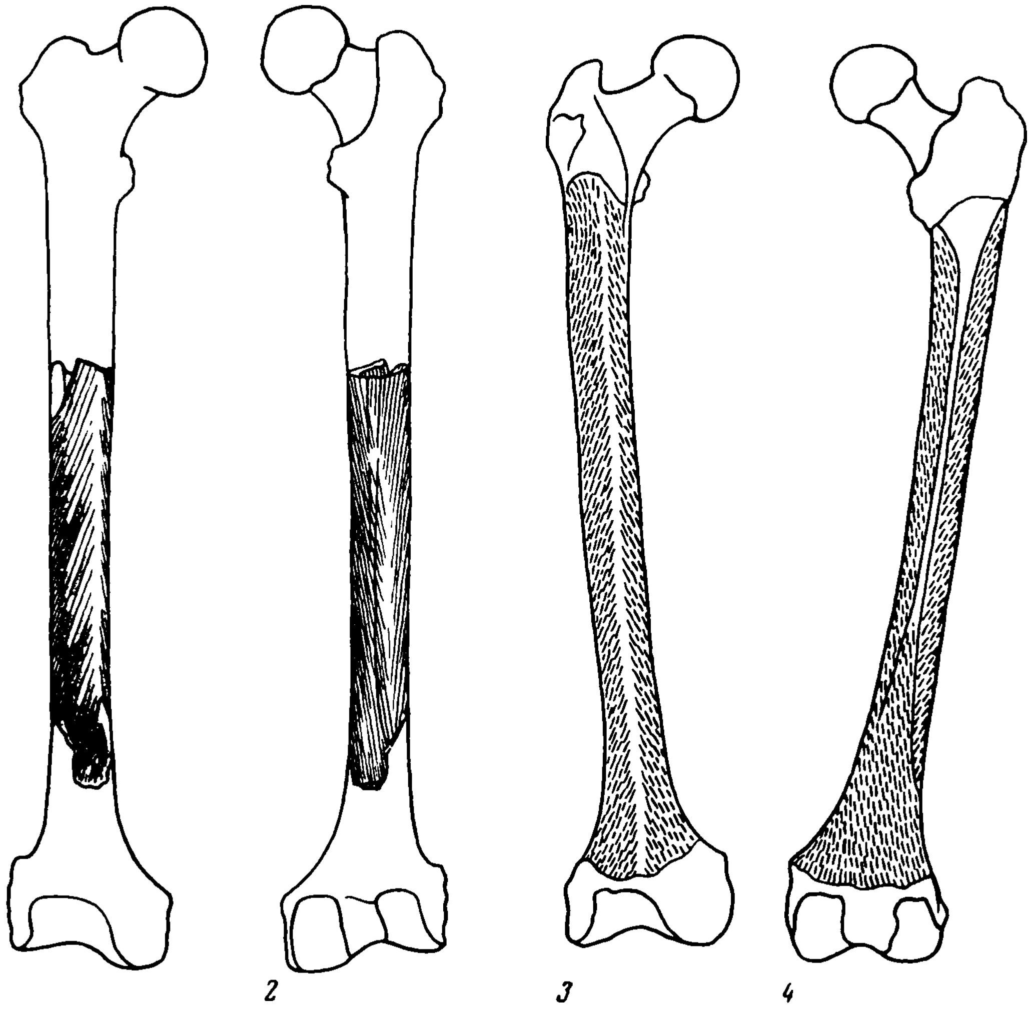
While Dubois spoke of the similarities between the Pithecanthropus and the great anthropoids, the gibbons in particular, Hans Weinert (1925) showed that it was more closely related to the modern African apes. He established the fact that the sinuses in the frontal bone of the skull (sinus frontales) are found only in the Pithecanthropus, man, the gorilla and the majority of chimpanzee species.

In the skulls of the gibbons, orangutans and the lower monkeys, these sinuses do not, as a rule, form. Once more the close relationship between man, the gorilla and the chimpanzee was confirmed: it had first been postulated by Darwin and was later supported by Gustav Schwalbe (1923), specialist in comparative anatomy, and by many biologists.

In a special monograph, Weinert (1932) made a detailed analysis of the features which the chimpanzee and other higher apes possess in

common with man. He drew the conclusion that man descended from a form of fossil ape that must have resembled the chimpanzee. Man and the chimpanzee must have had a common ancestor in the Pliocene Epoch; the gorilla branched off from the common trunk in an earlier period. It is to be regretted that Weinert did not deal in greater detail with the points of similarity between man and the other great apes, especially the gorilla, whose foot and brain and some other organs have points of especial similarity with the human type.

Be that as it may, the Pithecanthropus is of great interest on account of the fact that the cranial vault, in addition to the frontal sinuses, has other points of similarity with that of the chimpanzee, for example, the strongly expressed supra-orbital ridge and a narrowing of the skull behind the sinuses. The skull of the Pithecanthropus, however, is ob-



1 2 3 4

Fig. 101. Direction of osteons in compact layer of femur:
1, *2*—Pithecanthropus femur and *3*, *4*—modern human femur, ventral and dorsal aspects. After N. Sinelnikov, 1937.

viously much larger than that of the chimpanzee. The cranial capacity, too, is relatively greater—Pithecanthropus having 900 c.c. and the chimpanzee only 350-400 c.c.

Aleš Hrdlička (1930) considers that the cranial vault of the Pithecanthropus belonged to an elderly female whose height was 165 cm. The cranial capacity of the Pithecanthropus is half-way between that of man and the ape which justifies its name of ape-man. The structure of the femur shows that the Pithecanthropus walked upright.

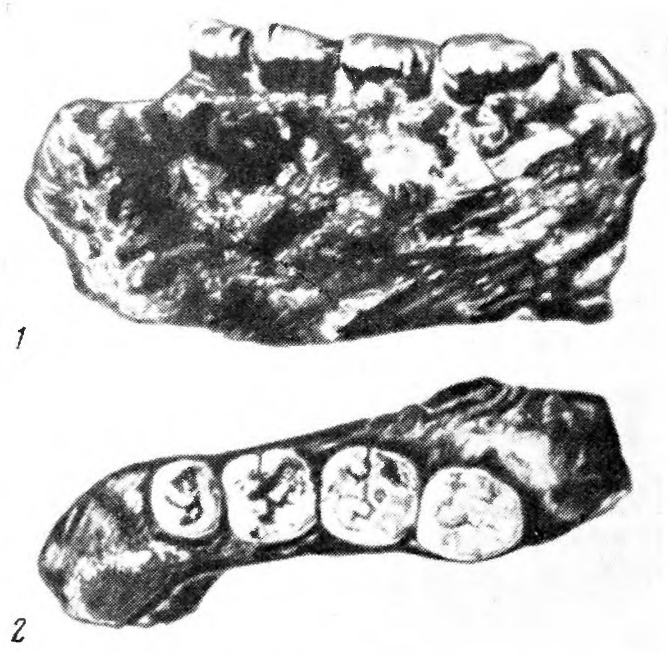


Fig. 102. Mandible fragment, Pithecanthropus II (found 1937):

1—interior and *2*—exterior aspect. $^2/_3$ natural size. After F. Weidenreich, 1938.

The place of the Pithecanthropus among the hominids was confirmed by the find of another skull on September 13, 1937, by the Netherlands palaeontologist G.H.R. von Koenigswald. Near the village of Sangiran, not far from the place where the first cranial vault was found, he discovered a Pithecanthropus skull and a fragment of a big mandible with teeth of the human type but of a much larger size (fig. 102). The remains were discovered in the lower Trinil strata of volcanic tufa. Koenigswald received the skull broken into 30 fragments from which he succeeded in reconstructing it.

The skull of Pithecanthropus II was very similar to that of Pithecanthropus I, but was somewhat smaller in size. Unlike Pithecanthropus I it had both temporal bones intact; their structure is human in character and differs sharply from those of the gibbons. It is noteworthy,

however, that on skull Pithecanthropus II the styloid process is poorly developed as it is in most anthropoids (it is well developed in most Neanderthalers and in all modern men). The right half of the frontal bone, the occiput and facial skeleton of Pithecanthropus II were not found.

And so skull Pithecanthropus II is also very incomplete, but it nevertheless enables us to draw fuller conclusions than Pithecanthropus I. Probably the most astounding thing is the small capacity of the cranium which is only 750 c.c. This is a feature that really makes the Pithecanthropus an intermediate stage between man's immediate predecessors and the other hominids.

The small capacity of the second cranium led Koenigswald to assume that the skull belonged to a female and that found by Dubois to a male. The difference between the two cranial capacities is about 150 c.c. The bones of the second skull, furthermore, are somewhat thinner than those of the first.

In any case, the Pithecanthropus II skull, having a cranium that is close in size to those of the great anthropoids, is of great scientific interest and confirms the ape-man nature of the Pithecanthropus.

The new mandible fragment is probably of equal importance in establishing the real nature of the Java ape-man. Four teeth, three molars and the second premolar, the latter resembling those of an anthropoid, have been preserved on it. Judging by the shallow socket for the canine its crown could not have been as big as those of the anthropoids. The third molar was bigger than the second, the second bigger than the first; the third molar (wisdom) tooth of all other hominids, and of modern man in particular, is usually reduced to a greater or lesser degree. The mandible has no chin and is very powerful. These morphological peculiarities make it possible to say with certainty that the Pithecanthropus is an ape-man.

In 1938, Koenigswald found a skull fragment belonging to a young individual at the same place—it was a parietal bone with part of the occiput. In 1939, Koenigswald managed to find the parietal-occipital part of the cranium belonging to a male Pithecanthropus and a fragment of a maxillary with a diastema between the canine and incisor teeth. Together with the mandible found in 1937 these parts enabled Weidenreich (1940) to reconstruct a male Pithecanthropus skull with a cranial capacity of 950-1,000 c.c. (fig. 103).

Still earlier, in 1936, the skull of a young individual of about six years of age, was found at the eastern end of Java at Mojokerto, near the town of Surabaya (Soerabaja). The length of the skull is 133 mm. and the cranial capacity nearly 650 c.c. Dubois believed it to be the skull of a young Javanthropus, but in more recent times it had been regarded as belonging to a young Pithecanthropus.

One of Virchow's chief reasons for assuming that the Pithecanthropus is an ape and not a man was the absence of any kind of tools in its vicinity. It will be remembered, however, that Dubois' finds were made

in a secondary deposit and had been carried there by a stream. In general it would require a vivid imagination to believe that the Pithecanthropus' stone tools could also have been carried there by the water and deposited in the vicinity of the skeleton. The question of whether the Pithecanthropus could use tools and even make them was one that had to be solved in principle.

Until quite recently the question was left open. The rather well developed brain of the Pithecanthropus gave supporters of the Darwin theory every reason to believe it most likely that it did use tools. This belief was

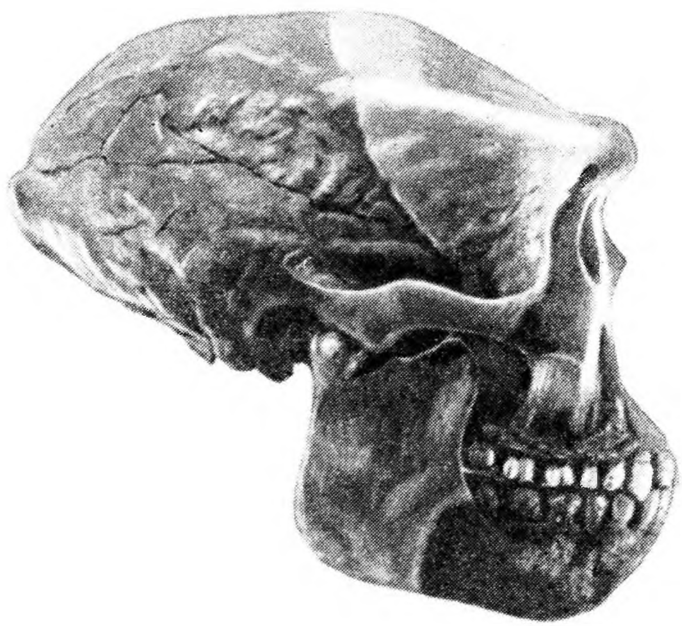


Fig. 103. Skull of Pithecanthropus IV, reconstructed from fragments found in 1937 and 1939.
$^1/_3$ natural size. After F. Weidenreich 1940.

confirmed indirectly by Koenigswald in 1939; in the same area as that in which the skull fragments Pithecanthropus II, III and IV were found he had the good luck to come across several very crude stone tools, one of them resembling a celt.

There can, therefore, now be very little doubt concerning the human nature of the Java Pithecanthropus (fig. 104). There are some scholars who believe that even the predecessors of the Pithecanthropi used and tried to make tools.

It seems that scientists have long since noticed pieces of flint and other rocks that lie together in clusters of several or of large numbers. In appearance they closely resemble the simplest stone tools. The majority of these stones are of medium size.

Fig. 104. Pithecanthropus. Reconstructed by V. Vatagin.
Museum of Anthropology, Moscow State University.

Such "tools" have been found in French Tertiary and Quaternary deposits by A. Rutot. They have been found by other scientists in various parts of Europe. Most of them show signs of having been trimmed on one edge, the other side of the stone being convenient for handling. Stone tools of this kind have become known as eoliths.

A number of scientists, however, have shown that stones that look like eoliths can be obtained naturally, for example, by the action of water

in tempestuous streams. It does not, of course, follow from this that all eoliths were produced by nature, although it is more than likely that those of the Tertiary Period were made by natural forces and not by man.

Is it not possible that natural objects were used as tools by Upper Pliocene terrestrial anthropoids such as the Australopitheci? It is quite possible that they used natural tools, but hardly likely that they fabricated them. At least there is no proof of the latter (see Raymond Dart's book on this subject). One of the oldest stones which scientists are quite certain is a tool, belonged to the Chinese ape-man, the Sinanthropus (M. F. Nesturkh, 1948).

2. THE SINANTHROPUS

The existence of the Pithecanthropus was fully confirmed by finds made in China where the discovery of the Chinese primitive man, Sinanthropus (Nesturkh, 1937, 1938, 1950), was one of the greatest importance to anthropology. The Peking man, or Sinanthropus, like the Pithecanthropus, lived in the first half of the Quaternary, somewhere about the middle of the period and shortly before the beginning of the ice age. It had a number of important features in common with the Pithecanthropus.

The village of Choukoutien is situated some 54 km. to the south-west of Peking (fig. 105). In the caves of a hill where mining operations were going on, the fossil remains of ancient animals and men were discovered. In 1927, Dr. Birger Bohlin found the molar tooth of a child. The peculiarities of its shape and structure led the British anatomist, Davidson Black, to define it as belonging to a hitherto unknown genus of fossil hominids. Black gave the name of Sinanthropus pekinensis (the China or Peking man) to this genus.

The find created a stir in the scientific world. Bohlin, Pei Wen-chung and other scientists from the Chinese Cenozoological Laboratory that studies the animals off the Cenozoic Era, launched an energetic search for Sinanthropus remains: their exploration of the Kotzetang cave was crowned with success—many human bones and teeth were found.

A comparison with the Pithecanthropus remains showed that there were great similarities.

Many traces of the Sinanthropus culture were discovered in the form of stone tools and the remains of fires. In addition there were many broken and charred animal bones. Everything points to the Sinanthropi as having been early men of primitive physical structure who were able to make crude stone tools, hunt animals and use fire; they lived collectively.

The Sinanthropi finds consist almost entirely of incomplete skulls, mandibles, teeth, clavicles and femurs. At first two cranial vaults were found, then fragments of lower jaws, many teeth and then, later, several cranial vaults and other bone fragments (Franz Weidenreich, 1937). Today the remains of about 50 individuals are known.

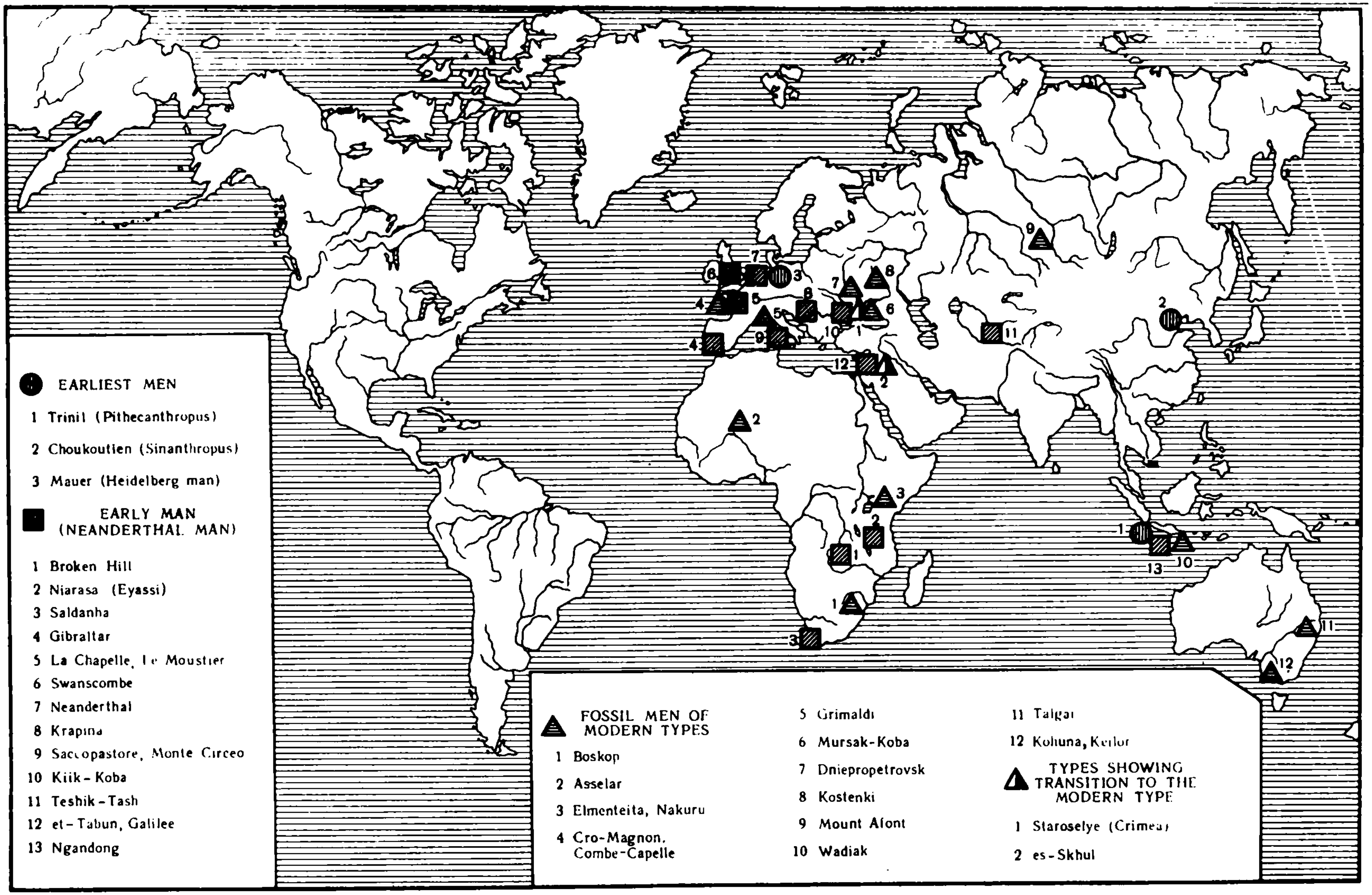


Fig. 105. Map showing sites where remains of fossil man have been found. After M. Nesturkh and S. Sidorov, 1955.

Fig. 106. Skull of Sinanthropus I, found 1929—superior and frontal aspects.
1/3 natural size. After H. Weinert, 1932.

The first cranial vault, found at a depth of 23 metres side by side with the skull of a rhinoceros, is that of a boy (fig. 106). This fragment was found by Pei Wen-chung in 1929. A year later, in 1930, Pei found a second Sinanthropus cranial vault, apparently that of a woman 30-35 years old. Pei was awarded the gold medal of the Geological Society of China for his discovery. The gold medal was also awarded to Davidson Black for the first description of the skulls. On the Sinanthropus II skull the temporal bones had been preserved with part of the styloid process, poorly developed, and part of the nasal bones. Othenio Abel expressed the opinion that the Sinanthropus had a wide, flat nose. The brain-case has a capacity of 1,025 c.c.

The shape and small size of the Sinanthropus skull are very similar to those of the Pithecanthropus, but the vault of the Sinanthropus skull is somewhat higher and the supraorbital ridge is a little thicker. These peculiarities show that the Sinanthropus was nearer to the next stage of human development, i.e., close to the Neanderthalers (M. M. Gerasimov, 1949, 1955).

The endocranial cast made from Sinanthropus I enabled Black to compute the capacity of the cranium at 900 c.c. The shape of the cast revealed obviously primitive features, such as the weakly developed frontal lobes. A certain asymmetry makes it possible to assume that the Sinanthropus was right-handed (M. F. Nesturkh, 1941; A. N. Yuzefovich, 1939).

The parietal region of the cerebral hemispheres was high, like that of the later hominids; it differs from the Pithecanthropus brain in which this area was low. On the basis of this Dubois regards the Sinanthropus as belonging to the Neanderthal type which, in his opinion, is confirmed by some peculiarities of their culture. Hrdlička (1933) agreed with Dubois. The Sinanthropus morphological pecularities taken together, however,

are closer to the Pithecanthropus. It would be more correct to regard both these types as "earliest" or "primitive" men.

An important find was that of an incomplete mandible belonging to an adult Sinanthropus with incisors, a broken canine and molar teeth. The mandible of a Sinanthropus child was also unearthed. Later nine mandibles belonging to individuals of various ages and both sexes were discovered (fig. 107). Weidenreich described them in a monograph in which he noted the rudiments of chin development and some small special processes on the lingual aspect of the mandible.

In another paper Weidenreich (1937) describes the dentition of the Sinanthropus and compares it with those of other fossil hominids and anthropoids; he notes a number of features that give them a remarkable resemblance to the teeth of the anthropoid apes. Among them is the very considerable development of the canine teeth with crowns higher than the other teeth (fig. 108). Weidenreich studied 147 teeth belonging to 32 individuals of which 12 belonged to children between the ages of approximately 4 and 14 years. Judging by the differences in the sizes of the teeth, 16 individuals were females (6 of them children) and 16 were males (also including 6 children).

The Sinanthropus teeth are bigger than those of the Neanderthalers or of modern man. The roots are very long, especially those of the incisors and canines. The cavity of the tooth, especially that of the lower molars, is very large, like that of the Neanderthalers and other

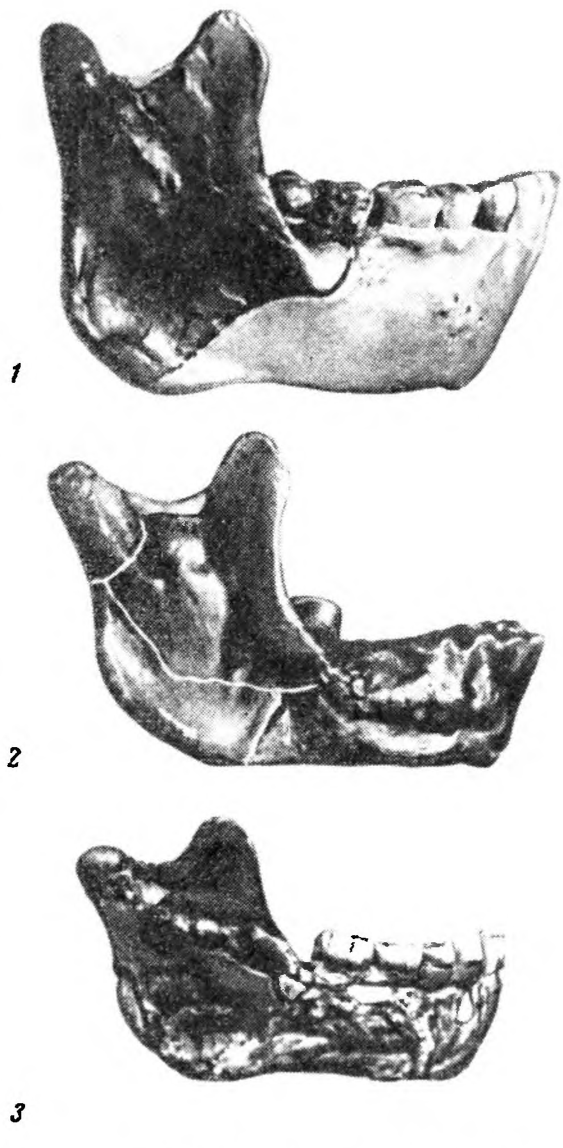


Fig. 107. Sinanthropus mandibles:
1—man; *2*—woman; *3*—child. $^2/_5$ natural size. After F. Weidenreich, 1936.

primitive fossil hominids. Taurodontism ("ox-tooth") of this type is found among modern people (in some groups up to 30 per cent) and also among the chimpanzees and female orangutans. It is a safe assumption that taurodontism among hominids is a fairly primitive peculiarity.

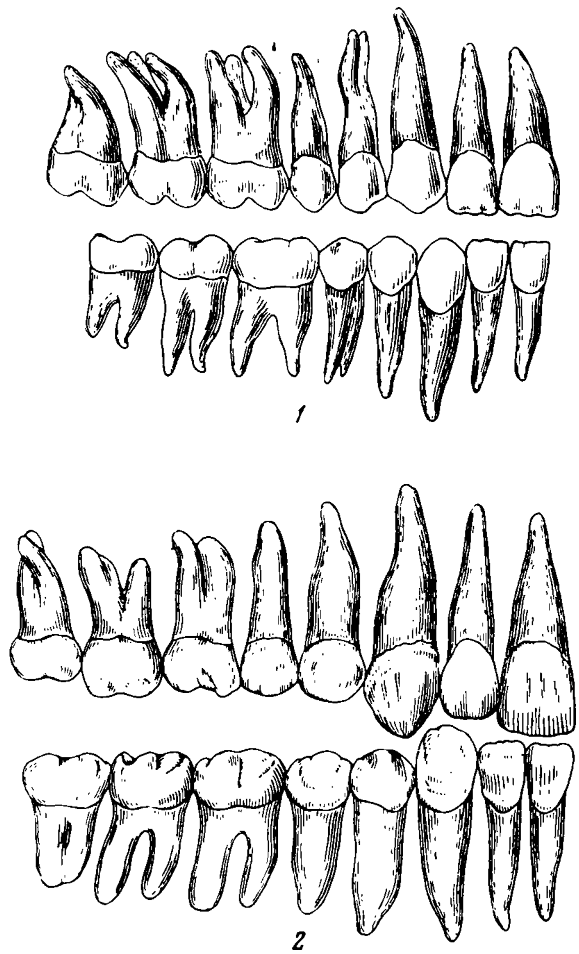


Fig. 108. Dentition of hominids:
1—Modern man; 2—Sinanthropus. $^{3}/_{4}$ natural size. After F. Weidenreich, 1937.

Another primitive feature of the Sinanthropus is the presence of diastemas in the deciduous dental system. These gaps are found either between the canine and the neighbouring incisor (upper) or the premolar (lower). In general the shape of the Sinanthropus teeth is much more primitive than that of the Neanderthalers, the latter bearing much more resemblance to the teeth of modern man. These typical structural peculiarities of the teeth, as well as a number of others, place the Sinanthropus among the "earliest men."

Weidenreich was of the opinion that the Australopithecus is closer to the Sinanthropus than any other fossil anthropoid. As far as the Dryopithecus is concerned, Weidenreich was mistaken in believing that the human line branched off from the common stem of fossil anthropoids prior to the development of the Dryopitheci with their powerful canines and premolars with cutting edges.

Of great importance in Weidenreich's work was his establishment of the fact that the lower premolars of the Sinanthropus, in the shape of their roots (divided into two and even three parts) and their crowns are very similar to the premolars of the anthropoids. This is a point that gives fresh support to the theory that man and the apes have a common origin.

Apart from the skull bones very scanty fragments of other parts of the Sinanthropus skeleton have been found: a clavicle and a semilunar wrist bone. At first, when only skull remains had been found, a French scientist, the abbé H. Breuil (1932), expressed the opinion that the cul-

tural traces found together with Sinanthropus remains must belong to some other, "real" people, who hunted the Sinanthropi and brought back only heads or skulls to their caves as trophies of the chase. Weidenreich was of the opinion that the Sinanthropi hunted each other and were the first cannibals.

Boule (1937) objected to Weidenreich's opinion and supported that of Breuil. He was of the opinion that real men hunted the Sinanthropi and that it was their stone tool industry that had been preserved in the caves at Choukoutien. Why, then, have not the bone remains of these "real" people been found in the caves? As there are none of them, Breuil's hypothesis is groundless. Weidenreich, too, can scarcely be right since the remains of animal and vegetable (nuts) food show that the Sinanthropus was omnivorous.

Breuil's contention that modern man existed as early as the Pleistocene has no scientific foundation; the abbé is an opponent of the theory that modern man could have descended from an ape and champions the hypothesis that *Homo sapiens* has always existed.

The 1936 excavations provided more valuable material in the shape of four new Sinanthropus skulls. In the same Kotzetang cave, in section L, some fragments of a skull were found that, although small in

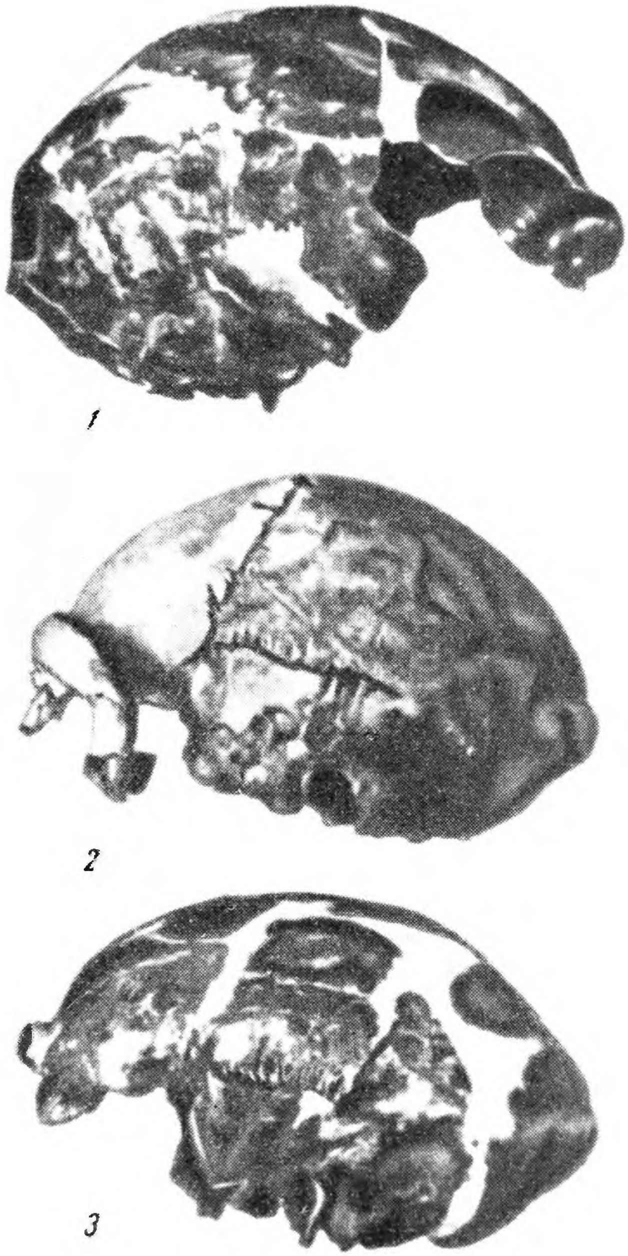


Fig. 109. Sinanthropus skulls, found 1936:
1—male from LI; *2*—female from LII; *3*—male from LIII. $^{1}/_{4}$ natural size. After F. Weidenreich, 1937.

size, had apparently belonged to an adult. The cranial capacity was 850 c.c. and Weidenreich was of the opinion that it was even smaller than skull Pithecantrophus I.

In accordance with his working hypothesis that the big skulls, mandibles and teeth of the Sinanthropus belong to males and the smaller ones to females, Weidenreich believed this skull to be that of a woman. He thought it probable that the Pithecanthropus skull found in Java in 1891 also belonged to a female; this had been said before by Dubois and later confirmed by Hrdlička.

Far more important was the find of three well-preserved but incomplete skulls of adult Sinanthropi (fig. 109). They were discovered at the same place in the autumn of 1936 (two are male and one female). Some parts of a facial skeleton found with them include zygomatic and nasal bones and parts of a maxillary bone. Skull LI belonged to a male, and had a cranial capacity of about 1,200 c.c.; skull LII is that of a female and has a cranial capacity of 1,050 c.c.; LIII is a male skull with a capacity of about 1,100 c.c. The basal bones of all three skulls are missing. Skull LIII is the best preserved and has an occiput with the posterior edge of the foramen magnum. In their general appearance all three adult skulls from section L are similar to skull I from section E which belonged to a boy 8-9 years old, but they have more strongly expressed supraorbital ridges and LI has a noticeable sagittal crest and surface roughness for the attachment of muscles to the temporal bones.

A comparison of the dimensions and peculiarities of the three L skulls and skull EI with Pithecanthropus and Neanderthal skulls gave Weidenreich the idea that the Sinanthropus occupies the lowest place relative

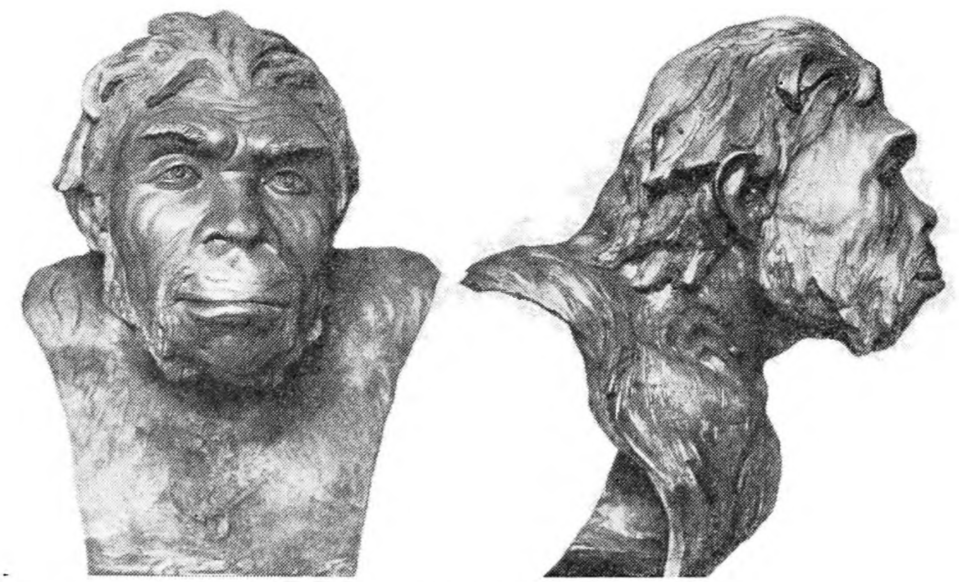


Fig. 110. Sinanthropus.

Reconstructed by M. Gerasimov. Museum of Anthropology, Moscow State University.

I *II* *III*

Fig. 111. Comparison of skulls:

I—female gorilla; *II*—Sinanthropus I (female, reconstructed by F. Weidenreich). *III*—modern man; lateral, frontal, superior and basal aspects. $^{1}/_{5}$ natural size. After F. Weidenreich, 1943.

to all other hominids in respect of those specific features that determine its position in the evolutionary scale, although skull LI has features that place it among the variations of the Neanderthal group; it is not only the biggest, it is also the highest.

Weidenreich believed that the Sinanthropus showed greatest similarity with the Neanderthaler found in Java, the so-called Java man (Javanthropus), whose skull structure is very primitive; at the same time Sinanthropus bears some likeness to Pithecanthropus. This is borne out by the similarity between cranial casts made from skulls of the Java man and the Sinanthropus. The more primitive form of the Sinanthropus' brain is revealed by the presence of a beak-like process (rostrum) growing inferiorly from the anterior part of the frontal lobe that is reminiscent of the brain structure of the chimpanzee and gorilla. This distinguishes the Sinanthropus from the Neanderthalers.

In general, if we may judge by the latest skull finds, the Sinanthropus (fig. 110) and the Pithecanthropus very closely approximated each other. Weidenreich regarded the main difference between them as being in the shape and degree of development of the supra-orbital ridge and the frontal sinuses. He noted that they were developed weakly in the Sinanthropus and strongly in the Pithecanthropus which is a reason to consider the Sinanthropus as the more primitive. In any case, it is clear that these earliest forms were the first stage in the evolution of the later hominids. The significance of the Sinanthropus fossils for our understanding of the first stage in man's development is very great (fig. 111).

The latest find of two femurs and one clavicle (all incomplete) that belonged to three different Sinanthropus individuals is of the greatest scientific importance. The bones were discovered by Pei Wen-chung among the material collected during the excavation of section E of the Kotzetang cave in 1936-1937. They bear great similarity to the bones of later hominids, including modern man. Judging by the structure of the femurs the Sinanthropus had a fairly erect gait and his upper extremities did not touch the ground.

When Weidenreich described the three bones in 1938 he said that the process of evolution had gone much farther and was much more clearly expressed in the development of the extremities than in the skull, especially the dental system. The clavicle was almost 31 cm. long and the femur 40 cm. Weidenreich estimated the height of the female Sinanthropus at 152 cm. and the male at 163 cm.

One of the femurs was charred. This circumstance and the fact that the bones were scattered gave Weidenreich grounds to repeat his highly improbable assumption that the Sinanthropi were cannibals.

In the same strata of the cave in which the Sinanthropus bones were found, many traces of its culture were also discovered. The Sinanthropi apparently got material for their stone tools from the opposite slope of the stream and from its bed, and also from more distant places.

In the cave there was also a large number of stones that had been

brought there but had not been worked on; there were also pieces of quartz and quartzite. This abundant material is sufficient to show that the implements were fabricated in the cave. The work was done collectively. One stone was used to chip others.

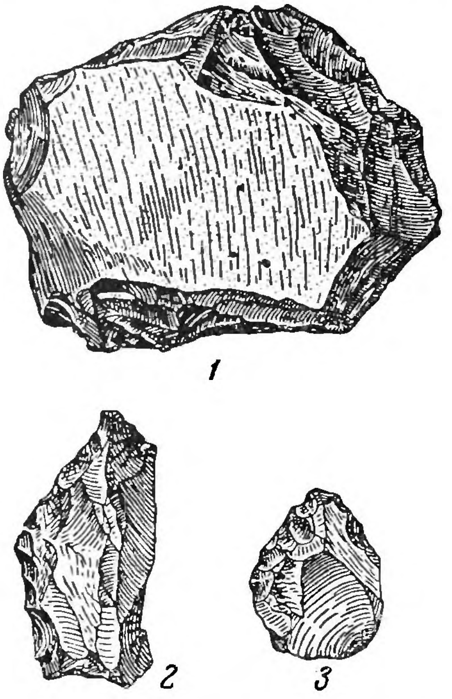


Fig. 112. Sinanthropus stone implements (front view):

1—knife-shaped rectangular tool (cutting edge at top); 2—implement resembling convex scraper; 3—type of combined scraper. $^1/_3$, $^1/_2$ and $^1/_2$ natural size. After D. Black, P. Teilhard de Chardin, C. Young and Pei Wen-chung, 1933.

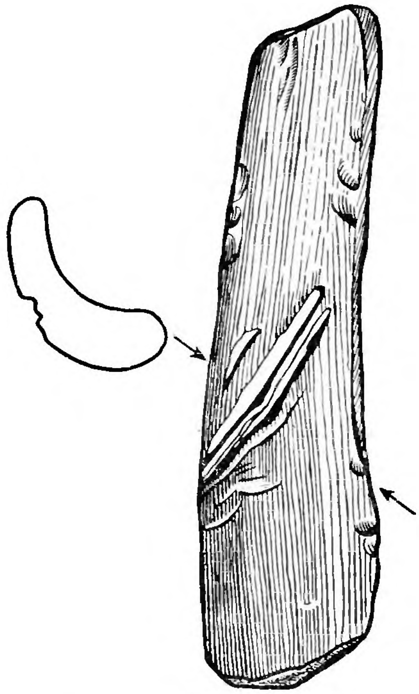


Fig. 113. Bone bearing marks made by stone cutting tool found in Kotzetang cave with Sinanthropus stone implements (left—cross-section showing cuts). After D. Black, 1933.

In the majority of cases the tools are small in size. The biggest of them is only 15 cm. long. Those found were triangular, rectangular and of other shapes, although it is difficult to classify them or determine their exact use (fig. 112). The workmanship is crude, the Sinanthropi obviously found it difficult to cope with such a task. As Black said in one of his papers, natural material was the master of the Sinanthropi rather than they of it. Some scholars are of the opinion that the crude tools of the ancient Peking man belong to one of the earliest stages in the development of Early Palaeolithic techniques and resemble the Acheulian tools from Clacton in East Anglia (P. P. Yefimenko, 1953). Other scholars, A. P. Okladnikov, for example, believe they more closely approximate the Early Mousterian technique.

In addition to the stone tools many bone fragments were found which some scholars are inclined to regard as bone tools. This was a very unexpected conclusion since the fabrication of bone tools had hitherto been

known only for much later epochs, beginning with the Mousterian. It is, however, permissible to assume that the Sinanthropi used bone tools (fig. 113). The numerous bones, many of them charred, belong to 70 different species of mammals and prove that the Sinanthropi hunted collectively, the objects of the chase being various animals, including the antelope and the deer. As they broke the long bones and the skulls in order to eat their contents, the Sinanthropi must have seen the possibility of using bone fragments and sharp antlers as implements.

Everybody knows how easy it is to prick or cut oneself on a sharp bone. The Sinanthropi probably made use of bones both as tools and as weapons, for example, in quarrels among themselves, when a bone happened to be handier than a stone. The antlers of young deer could serve them as weapons, the attached part of the skull, in Breuil's opinion, being used as the hilt. The mandibles or antlers of deer and antelopes could have served as clubs and hammers. Some of the bones and antlers of these animals are split and there are signs that they had been treated by heat at the places split. Breuil also believed that the bowl-shaped parts of the skull could have served the Sinanthropi as drinking vessels; the edges of some of them have been made smooth and they appear to have been polished by long usage.

Probably the most remarkable fact is the Sinanthropi's regular use of fire. Ashes and small cinders and occasionally charred twigs among them have been found in considerable numbers. In one place the layer of ash with such remains in it was seven metres thick. In this layer stones and bones that had been subjected to fire were found.

The Sinanthropi apparently occupied that cave for several centuries. Many generations of these earliest people lived out their primitive lives there, lives that were full of difficulty, danger and disease. The cave sheltered them in bad weather and protected them from wild animals, they went out in search of material for their tools and fabricated them collectively in the cave, they went out hunting, brought the meat to their cave (fig. 114) and roasted it over the fire.

The treatment by fire of meat and other animal products, as well as certain plants used by the earliest people as food, undoubtedly made them more digestible. The new properties of the food were certain to bring about changes in the organism that were, in many cases, favourable. In view of the fact that meat formed a substantial part of the Sinanthropus' diet the significance of its digestibility is one that cannot be denied: "A *meat diet* contains in an almost ready state the most essential substances required by the organism for its metabolism. It shortened the time required, not only for digestion, but also for the other vegetative bodily processes corresponding to those of plant life, and thus gained further time, material, and desire for the active manifestation of animal life in the proper sense of the term."*

* F. Engels, *Dialectics of Nature*, Moscow 1954, p. 236.

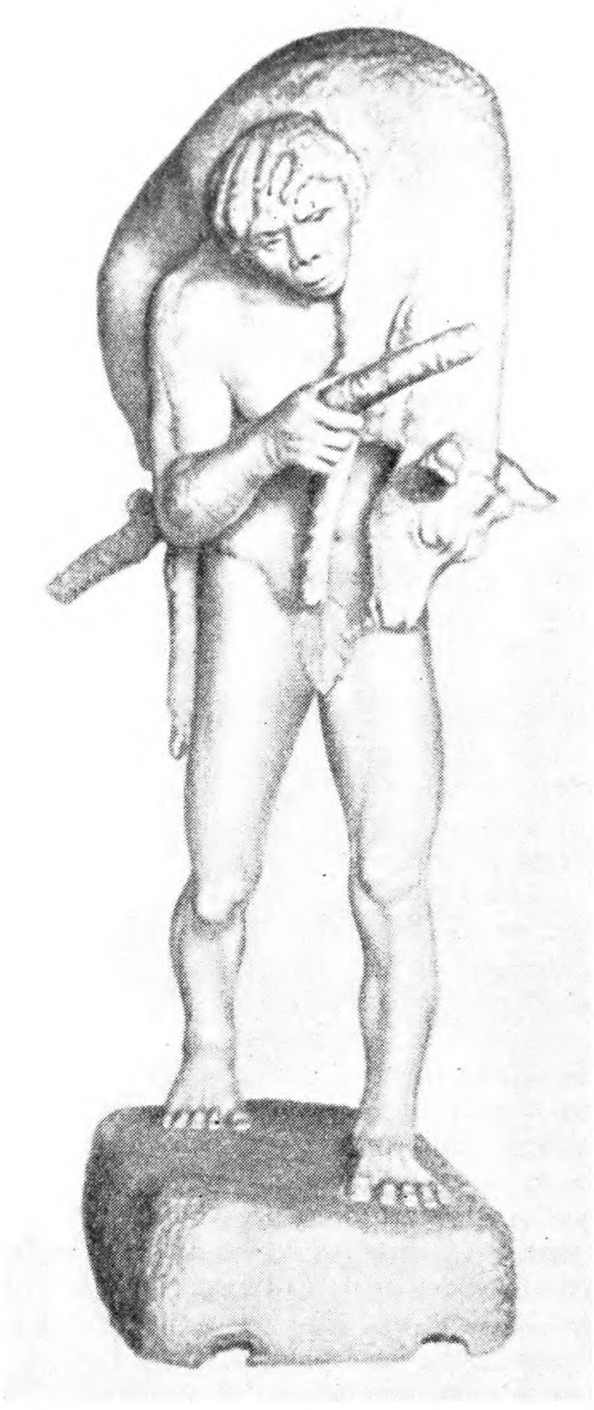


Fig. 114. Sinanthropus returning from hunt.
Reconstructed by Pei Wen-chung, 1954.

Changes in diet were reflected in the structure of various organs of the human body. The small intestine became somewhat shorter. The masticatory apparatus became weaker and shorter, and, together with it the facial region of the skull; the dentition also underwent changes. Together with and correlated to these latter changes was a thinning of the walls of the cranium and a reduction of the external relief of the skull (W. D. Wallis, 1931), i.e., processes that were intimately connected with the progressive development and increase in size of the brain. It may be assumed that the influence of the new diet, with its greater concentration of complicated organic chemical compounds, also had its effect on the brain and, as Engels noted, in the most significant manner. Engels was of the opinion that our ancestors, the fossil men-in-the-making, could not have become "complete" men without a meat diet, the acquisition and distribution of which facilitated the development of the social instinct.

It is probable that the Pithecanthropi had not learned the use of fire but the Sinanthropi had mastered the use of that great natural force.

Engels regarded the use of fire as being of the greatest importance to the development of man. He said: "On the threshold of human history

stands the discovery that mechanical motion can be transformed into heat: the production of fire by friction; at the close of the development so far gone through stands the discovery that heat can be transformed into mechanical motion: the steam-engine. And, in spite of the gigantic liberating revolution in the social world which the steam-engine is carrying through—and which is not yet half completed—it is beyond all doubt that the generation of fire by friction has had an even greater effect on the liberation of mankind."*

The invention of fire-making by friction was probably preceded by other methods of obtaining and using fire, e.g., by igniting dry twigs from hot lava left from volcanic eruptions, the retention of burning branches after forest and steppe fires and the maintenance of fire by feeding it with various inflammable materials. After forest fires the earliest men must have found the charred bodies of animals, the edible parts of which they used as food. Some of the useful properties of roast meat may have served as one of the moments stimulating the development of the artificial use of fire.

Undoubtedly, primitive methods of using and obtaining fire must have been practised over a very lengthy period; their beginnings are hidden in the depths of the still little-known life of ancient men. It is also possible that man first made a close acquaintance with fire through the sparks that flew off when tools were being fashioned (Porshnev, 1955).

The Sinanthropi probably not only knew the use of fire, but also how to obtain it. It is possible that they made use of one of the simplest methods of obtaining fire by scraping, sawing or drilling** (P. I. Boriskovsky, 1950).

Most likely different groups of our ancestors did not develop at the same rate; even today various peoples stand at different cultural levels due to different rates of development. In any case, people who had invented tools and learned to use fire and who had discovered the usefulness of these things in the struggle for existence would not later forget them but would perfect the use of them. All this leads us to the idea that we may regard the group of Sinanthropi that lived in the Choukoutien cave in preglacial times as being one of the tiny centres of primitive man. Further excavations of the site are very necessary and are now being carried out by Chinese archaeologists.

---

* Frederick Engels, *Herr Eugen Dühring's Revolution in Science*, Moscow 1954, p. 159.

** Scraping was the process in which a hard piece of wood was rubbed along another piece in the length, sawing was rubbing across the grain, both under pressure. The third method, drilling, was very widespread; a thick stick was twisted between the palms in a hole in another piece of wood or was rotated by means of a thong, pressure from above being exerted.

As we have already said, the Pithecanthropus and Sinanthropus lived at the beginning of the Quaternary Period, before the onset of the cold, i.e., in preglacial times. These primitive men lived in hordes that were to a great extent isolated from each other in contiguous regions of South and South-East Asia. They had contemporaries in Europe and Africa, even in those ancient times, the Chellean and Acheulian folk. A find made in Western Europe, the Mauer mandible, is extremely old as far as geological age is concerned: some scholars are of the opinion that it is of the same geological age as the Sinanthropus finds. There are other scholars who believe that the geological strata of Europe and Asia can scarcely be compared chronologically and that it is even possible that the Heidelberg man lived somewhat earlier than the Sinanthropus, the Peking man (P. P. Yefimenko, 1953).

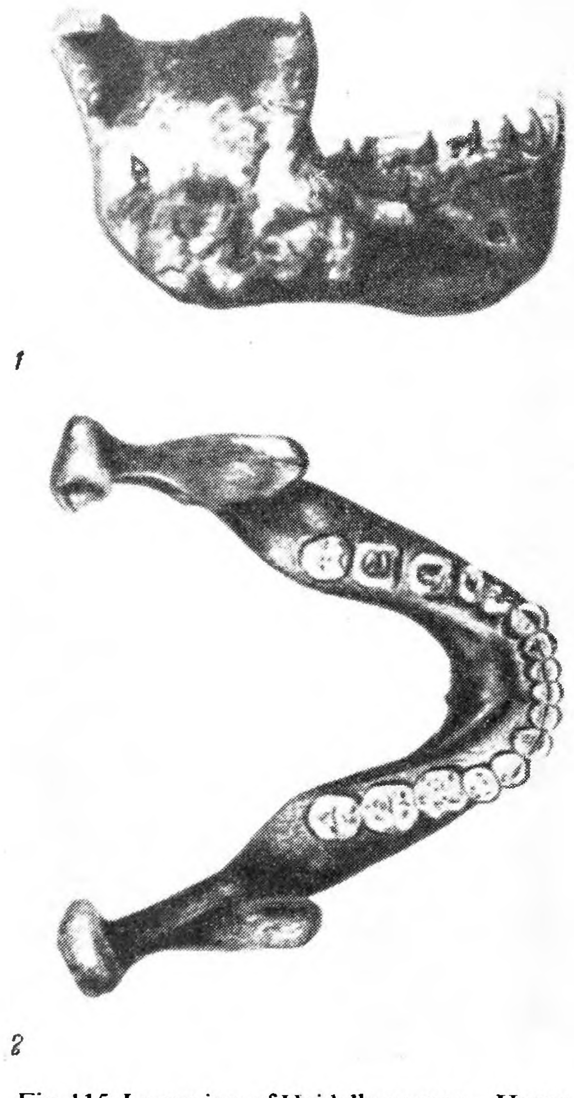


Fig. 115. Lower jaw of Heidelberg man—Homo (Palaeanthropus) heidelbergensis Schoetensack—found in sand quarries at Mauer, near Heidelberg, 1907.

1—lateral and *2*—superior aspects. $^3/_8$ natural size. After O. Abel, 1931.

Nevertheless, it is most probable that the Peking man (whose culture was, in general, higher than that of the unknown makers of the Chellean tools, the contemporaries of the Heidelberg man) lived earlier than the Mindel-Riss interglacial period that lasted tens of thousands of years.

The Mauer mandible, found at a place of that name near Heidelberg, Germany (1907) and shortly afterwards described by Otto Schoetensack (1908), is ascribed to that epoch. Schoetensack kept watch on a stratum of ancient

sand that was being quarried at that place for almost twenty years. He was constantly calling the attention of workers there to the necessity of preserving the fossil bones of animals that turned up from time to time and to the possibility of finding the fossil bones of ancient man.

The massive human mandible was discovered at a depth of nearly 24 metres. Its structure is a mixture of human and simian features (figs. 115 and 116). The mandible has huge dimensions and extremely wide rami; there is no chin ridge. It is, therefore, very primitive and to a great degree even bears comparison with the mandibles of the Pithecanthropus and Sinanthropus. But the teeth are quite human and, in their development, are far in advance of the teeth of the earliest men; from this point of view, therefore, the Mauer or Heidelberg fossil man is somewhat nearer to the Neanderthalers who lived at a later geological date.

Many investigators place the Heidelberg man among the earliest humans. But Weidenreich proposes to include him among the Neanderthalers. Weidenreichs' opinion has some sound foundation, because the Mauer jaw more or less fits the La Chapelle skull. And, indeed, its

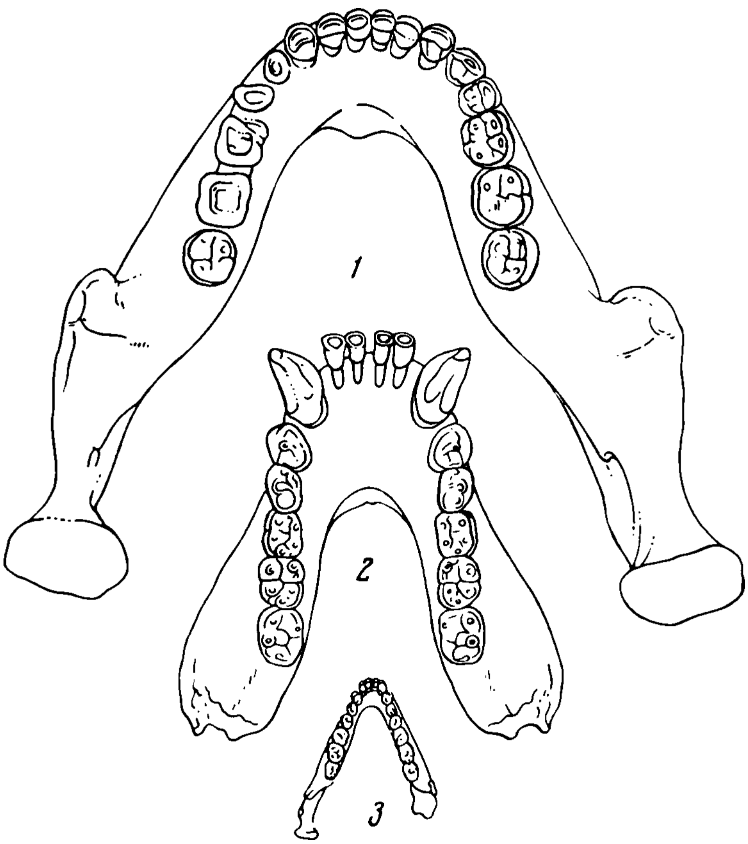


Fig. 116. Lower jaws:
1—Heidelberg man; *2*—Dryopithecus (Dr. fontani Lartet); *3*—Parapithecus (P. fraasi Schlosser). $^{1}/_{2}$ natural size. After W. Gregory, 1922.

antiquity is not so great, many modern writers on the subject placing it in the Riss glacial epoch: this makes the Heidelberg man a contemporary of the Neanderthal man. A few years ago three mandibles of ancient men where found at Ternifine (Algeria) together with tools of the Chellean type; they were given the name of Atlanthropi (Arambourg, 1954; Yakimov, 1956; Uryson, 1957).

To sum up: as far as can be judged, the Pithecanthropus and the Sinanthropus are the earliest fossil men. They represent the earliest stage in the making of man, the initial and extremely long stage of the transition from a simian to a human being. In Engels' words, these were men-in-the-making, transitional types that were the predecessors of the Neanderthalers, i.e., representatives of the second stage of the transition from ape to man.

The finds of bone remains and traces of the culture of the earliest men are of tremendous significance for the development of anthropogenesis theories. They confirm Darwin's theory of the descent of man from the highly developed fossil anthropoid apes and Engels' theory of the decisive role played by labour in the transition from ape to man.

CHAPTER TWO

THE SECOND STAGE: EARLY MEN (PALAEANTHROPI)

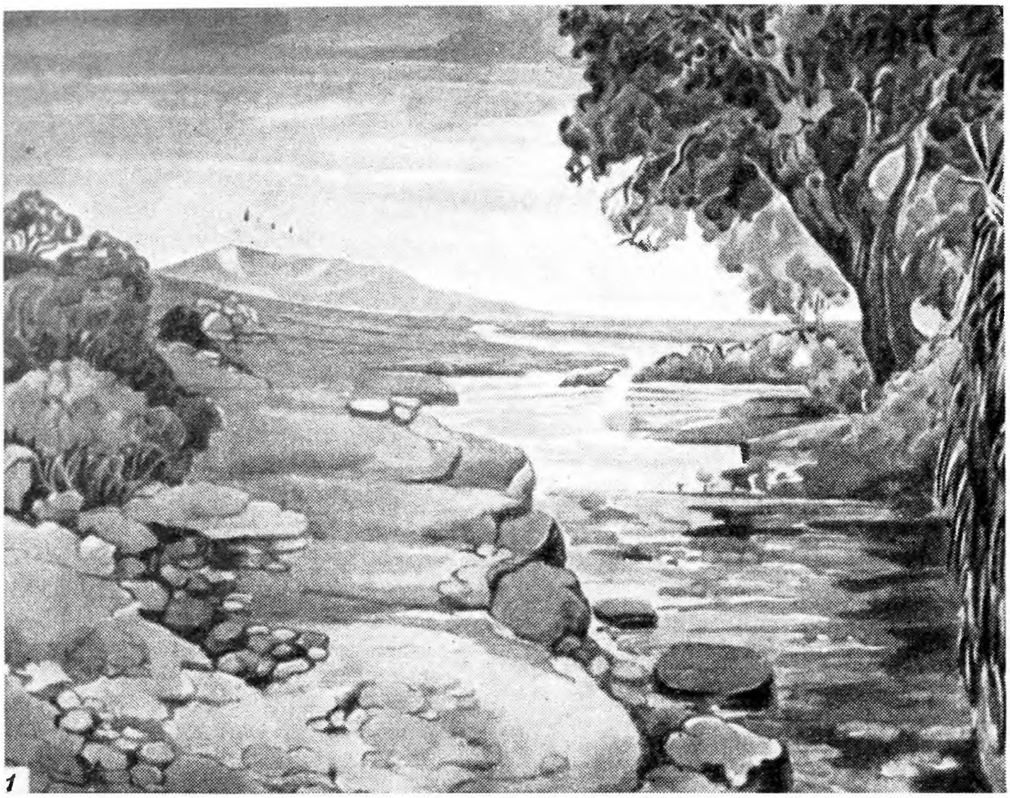
1. THE ICE AGE

The earliest remains of man known to us, those of the Pithecanthropi and Sinanthropi, were found in geological strata dating back to the first half of the Quaternary Period. The period lasted about a million years and may be divided into three epochs of unequal length and character—the preglacial, glacial and postglacial or recent epochs (fig. 117). The first two constitute the geological Pliestocene Epoch and the third corresponds to the Holocene in a terminology that is analogous to that also used for the Tertiary Period of the Cenozoic Era. The advance and retreat of an ice sheet over huge areas of Europe, Asia and North America is typical of the Quaternary Period.

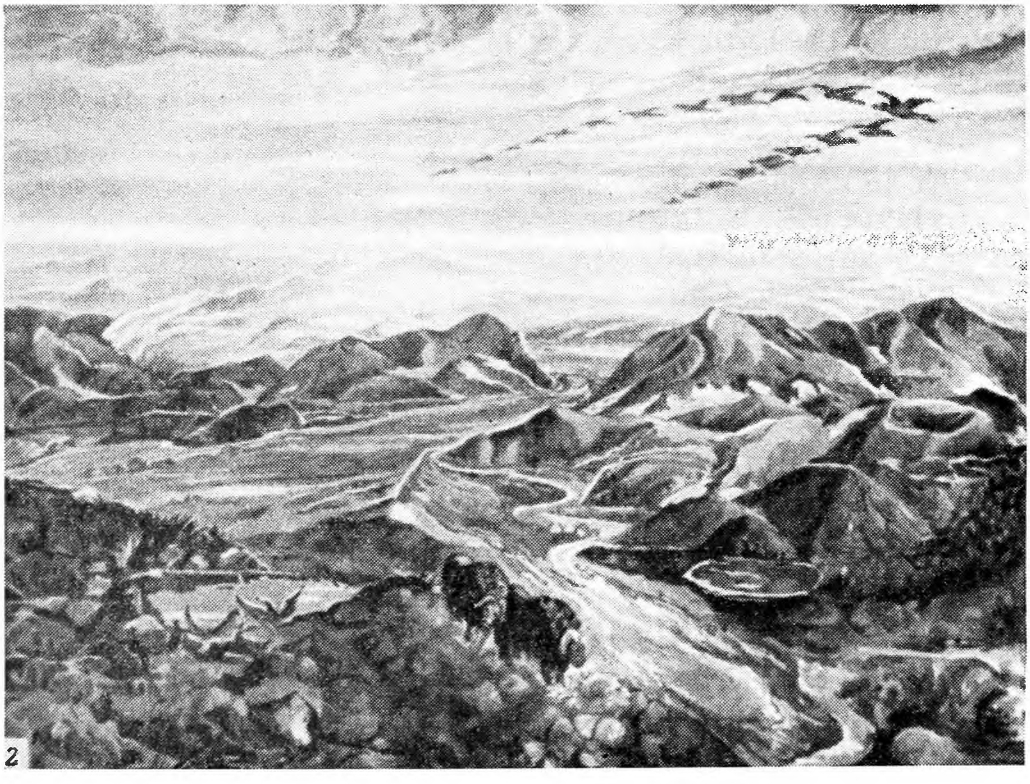
P. P. Lazarev (1929) is of the opinion that the advance of the cold front was due to certain changes in the distribution of the land and water masses in the polar basin of the Northern Hemisphere, changes that disrupted the flow of the cold and warm currents. At the end of the Tertiary and in the Early Quaternary periods "parts of the future continent of Europe were isolated from warm ocean currents and the polar area obtained no warm water from the equatorial currents," writes Lazarev.

G. Simpson (1930), on the contrary, believes that the spread of the ice in the Pleistocene was due to intensified solar radiation and the evaporation of water from the oceans. This view, however, has not been generally accepted. The increased humidity of the atmosphere and some lowering of the temperature would probably have been sufficient for masses of ice to accumulate in the north, similar to that still remaining in Greenland, where it is gradually melting at the edges.

The ice sheet spread southward, especially in Europe, and covered not only the Scandinavian Peninsula and the British Isles, but also parts of what are now Germany, France and Poland, as well as a considerable part of the European territory of the Soviet Union, reaching, in the



1



2

3

Fig. 117. Landscapes of Pleistocene epochs:
1—preglacial; *2*—glacial; *3*—early postglacial. Moscow Museum of Anthropology.

south and south-east, the vicinity of the modern cities of Dniepropetrovsk, Tula and Penza.

If we add to this the areas that were iced over in Asia and North America the territory covered by the ice sheet, in places hundreds of metres thick, amounted to approximately 8,000,000 square kilometres.

The deposits of sand, clay, boulders and loess left after all the glacial and interglacial epochs today cover a considerable area. This can be seen, for example, in the European part of the Soviet Union. It is by these deposits and by the corresponding stratification of the other parts of Europe that the main features of Quaternary geological history have been established, the history of the period in which mankind took shape, beginning with the Pithecanthropus and Sinanthropus.

The frequent changes of climate, the alternate advance and retreat of masses of ice, had an enormous influence on the development of the animal and vegetable kingdoms in places adjacent to the ice, especially as there was a simultaneous fall or rise of some regions in that part of the world and in contiguous areas of other continents. This may have resulted in the migration of some animals from Asia and Africa to Europe and vice versa. Early man must have taken part in the migration since his life was closely connected with the availability of edible plants and game.

Many scholars are of the opinion that there were four ice ages: 1) Günz, 2) Mindel, 3) Riss and 4) Würm. They were given these names by Albrecht Penck from the places in the Swiss Alps where he made a detailed study of those epochs. In his opinion each epoch lasted 25,000 years. Three warmer "interglacial" epochs lasted 175,000, 200,000 and 100,000 years respectively.

To compute the length of the Quaternary Period, Penck proposed the time that has elapsed since the Würm epoch to the present day, i.e., 25,000 years, as the unit of time. If this figure is doubled, as Soviet geologists propose, all other figures will also be doubled, their absolute value being established by the use of all the data obtained from the study of the Quaternary Period in Western Europe and the European part of the U.S.S.R. The interglacial epochs are called: Günz-Mindel, Mindel-Riss and Riss-Würm respectively.

In recent years the theory of polyglacialism, an ice age divided into a number of epochs, has been shaken to the foundations by the works of Soviet geologists and palaeontologists. The work of V. I. Gromov (1948) is of great interest in this connection. He considers that the theory of polyglacialism is based mainly on the data provided by lithology, with the aid of which attempts have been made to settle the question, for example, of whether or not boulders and other geological features belong to formations of glacial origin; furthermore, he says, the data used to compute changes in the snow-line of earlier epochs are purely geomorphological, the calculations proceeding from the presence of a series of river terraces with moraine deposits at various heights.

Data obtained from flora and fauna and from the fossil remains of man, continues Gromov, have either not been used at all as proof of the alternation of glacial and interglacial epochs or have not been made full use of. In his opinion there is no basis, either in palaeontology or archaeology, for the theory of a number of ice epochs in the Quaternary Period alternating with interglacial epochs that enjoyed a milder climate than today's and had a much higher snow-line.

On the basis of a study of the fauna of the Soviet Union as far as 60° north latitude, mainly in the European part of the country, Gromov (1948) distinguishes three phases in the Quaternary Period: 1) the preglacial (Mindel and Mindel-Riss), 2) the glacial (Riss, the Riss-Würm interstage and Würm) and 3) the postglacial phases. It was only in the second half of the Quaternary Period that cold-hardy fauna of the arctic type developed and became typical for a lengthy span of time. Fauna before the phase had been more varied and shows three changes of genetically connected fauna groups, none of which, however, contained any arctic animals.

There came a radical change in the type of fauna in early Mindelian times, the subtropical animals disappeared altogether and were replaced by a new fauna for which the Elasmotherium, southern elephant and Etruscan rhinoceros were typical; it is here that Gromov draws the bound-

ary line between the Tertiary and Quaternary periods. The radical change in fauna, says Gromov, was due to a sharp deterioration in climatic conditions. In Pre-Mindelian and Mindelian times the climate first became markedly continental, then cold and, lastly, came the icing of Eurasia.

Next came the sudden change to a warm climate in the early post-glacial epoch following the Würm stage that brought with it relevant changes in other natural conditions and effected a sharp turning-point in the history of the fauna—the rapid extinction of arctic species and the gradual extinction or impoverishment of fauna due to the disappearance of such animals as the horse, the camel and the glutton.

The worst conditions for many species of animals were undoubtedly those of the greatest ice phase at the Riss stage. At this time many species became extinct, some migrated and still others underwent an evolutionary adaptation. Animals typical of the epoch were the ancient elephant (Elephas trogontherii), the long-horned bison and the giant reindeer.

In Gromov's opinion the Riss epoch was a critical one in the development of the animal and vegetable kingdoms in the relevant areas of Eurasia, an epoch in which ancient man also had a hard time. The epoch of maximum glaciation included the Mousterian cultural epoch, i.e., the epoch of the Neanderthalers and, in its latter half, of the Cro-Magnon folk.

Thus Gromov considers that a study of the remains of animals and tools should correlate the Neanderthalers with the first half and the later epochs of maximum glaciation and the Cro-Magnon folk with the latter half, so that the Aurignacian comes within the second half of the epoch of maximum glaciation and Solutrean and Magdalenian in the Riss-Würm and Würm stages. The late Palaeolithic folk hunted the mammoth and the reindeer, these animals and the woolly rhinoceros being typical representatives of the fauna of that epoch; they also hunted horses.

The Neanderthal and Heidelberg men lived, according to Gromov's scheme, in the Mousterian, Chellean and Acheulian epochs while the Sinanthropi lived in the pre-Chellean epoch, that which corresponds to the Günz-Mindel—the epoch of transition from the Tertiary to the Quaternary Period. Lastly, Gromov relegates the Pithecanthropi to a still earlier epoch at the end of the Pliocene, which corresponds to the Günz epoch in the former terminology.

In general, of the million years of the Quaternary Period the first 500,000 are taken up by the preglacial epoch, the beginning of the glaciation and the first half of the epoch of greatest glaciation. The first phase of cultural development, the Early Palaeolithic, with its low level of stone tool techniques, is covered by this epoch (P. P. Yefimenko, 1953).

This is the period of amorphous tools that had no definite shape and cannot be classified in clear types. The types of stone celts, scrapers and

spearheads found among the artifacts of the Middle Palaeolithic camping grounds (this epoch lasted 300,000-400,000 years) fall into fairly well defined types. The Late Palaeolithic Epoch with its rich assortment of new types of stone tools belongs to the last 100,000-150,000 years of the Quaternary Period (S. N. Zamyatnin; see symposium *The Origin of Man*, 1951).

The makers of the amorphous tools were the earliest men, the Middle Palaeolithic tools were made by the Neanderthalers, and in the Late Palaeolithic more complicated tools in a richer assortment that included cutting tools and bone artifacts were made by the Cro-Magnon people.

During the series of cold spells, or ice ages, the animal and vegetable kingdoms and with them man, retreated before the advancing ice to the south, south-west and south-east. In the interglacial periods man again spread over the ice-free territory that first acquired a plant population followed by animals (G. I. Lazukov, 1954).

The manner of man's existence changed under the influence of a constant struggle for subsistence in abruptly changing natural conditions. Men made their tools and hunted collectively; at first they hunted small mammals, but later they hunted big animals like the elephant, and gradually became dangerous rivals to them. Sharp stones and clubs in the hands of primitive man often more than made up for his deficiencies in natural means of attack.

2. NEANDERTHALERS AND THEIR PHYSICAL TYPE

The Neanderthal stage in the development of hominids is representative by numerous finds of bone remains discovered in various parts of Europe, Asia and Africa. The Neanderthalers lived mostly in the middle epoch of the Old Stone Age, the Middle Palaeolithic. This was the first half of the phase of maximum glaciation which corresponds to the Riss epoch. This distant time is also known as the Mousterian Epoch.

Many Western scholars equate the Mousterian Epoch with Riss-Würm or even Würm. But the entire Middle Palaeolithic, as we have already said, occupied several hundred thousand years. It is divided in greater detail by the character of tool fabrication. Bone tools appeared only at the end of the Mousterian Epoch. Stone tools typical of the Neanderthalers were found together with the skeleton of a young man in the lower grotto at Le Moustier, France, in 1908 (fig. 118) and in other places.

The first skull of an adult Neanderthaler was found in 1848 in a stone quarry at Gibraltar (Spain). It was an incomplete female skull with a weakly-developed supra-orbital ridge (fig. 119) and its cranial capacity was only 1,080 c.c. At the same place in 1926 stone tools and the skull of a five-year-old Neanderthal child were found.

In the Feldhofer Grotto near Düsseldorf, at the mouth of the River Düssel (in the Neanderthal Valley, Germany), the cranial vault and parts

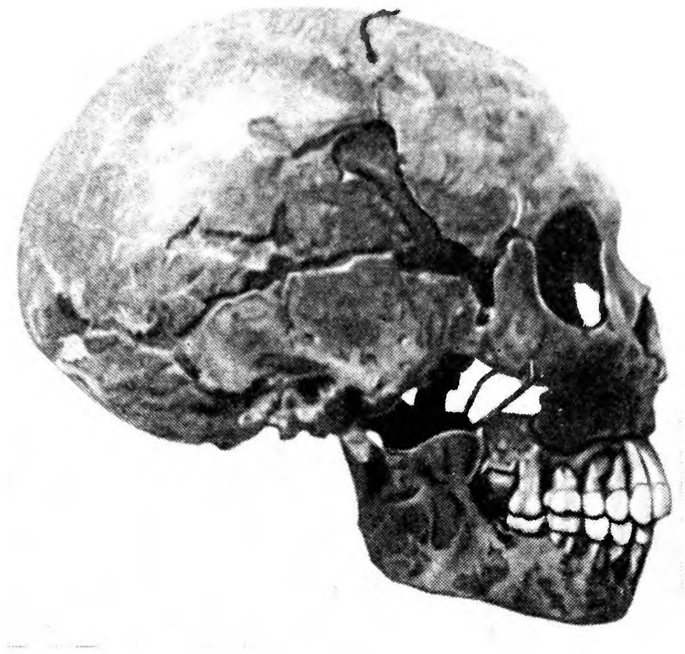


Fig. 118. Skull of young Neanderthaler (Homo neanderthalensis King) from lower grotto at Le Moustier. 1/3 natural size. After A. Hrdlička, 1930.

of the skeleton of a Neanderthaler were discovered (fig. 120). The cranial capacity of this specimen was rather big for primitive men of that type—about 1,400 c.c.—but the forehead had a very considerable slope and there was a very pronounced, continous supra-orbital ridge like that of the chimpanzee.

A very considerable discussion arose around the skull from Neanderthal. The German scholar, Rudolf Virchow, was of the opinion that the skull belonged to modern man but had acquired that form through some pathological process. He also believed that the pressure of the earth strata had later had some effect on the shape of the skull.

Darwin did not attach great importance to the Neanderthal skull and only remarked on its antiquity and great size. This find was for a long time an isolated one, like the Gibraltar skull. Only at a much later date were more and more skulls and bones of a similar type found together with similar crude stone tools.

The remains of the skeleton of a male Neanderthaler 50-55 years of age taken from the lowest stratum of the Bouffia cave near the village of La Chapelle-aux-Saints (France) in 1908 was of considerable importance.

This skull (fig. 121) had all the specific features that are peculiar to the majority of Neanderthalers:

1) a powerful supra-orbital ridge and sloping forehead;

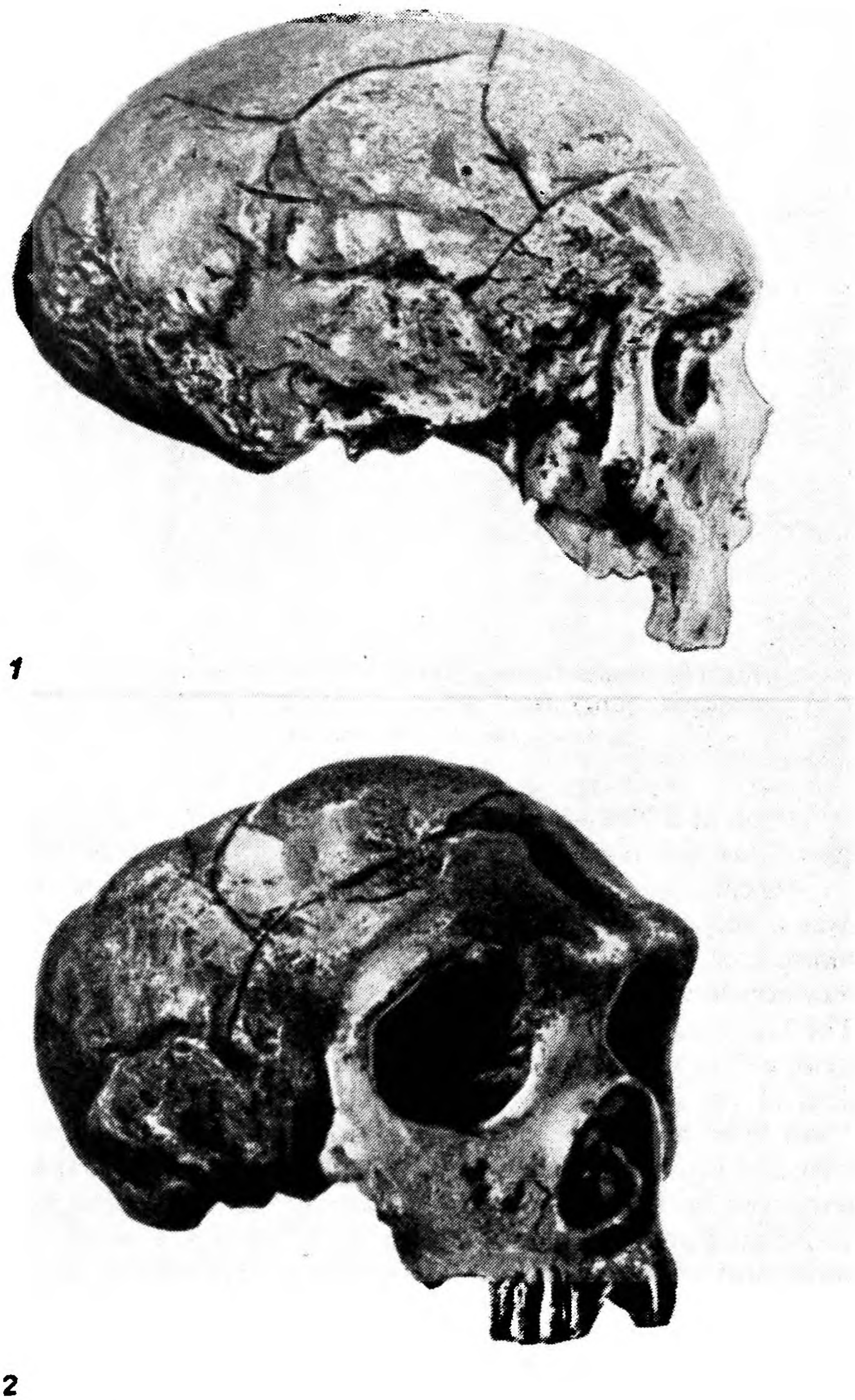


Fig. 119. Skull of Neanderthal woman from Gibraltar:
1—profile and *2*—three-quarter views (from a cast) $^3/_8$ natural size. After A. Hrdlička, 1930 *1*), and Th. Mollison, 1932 (*2*).

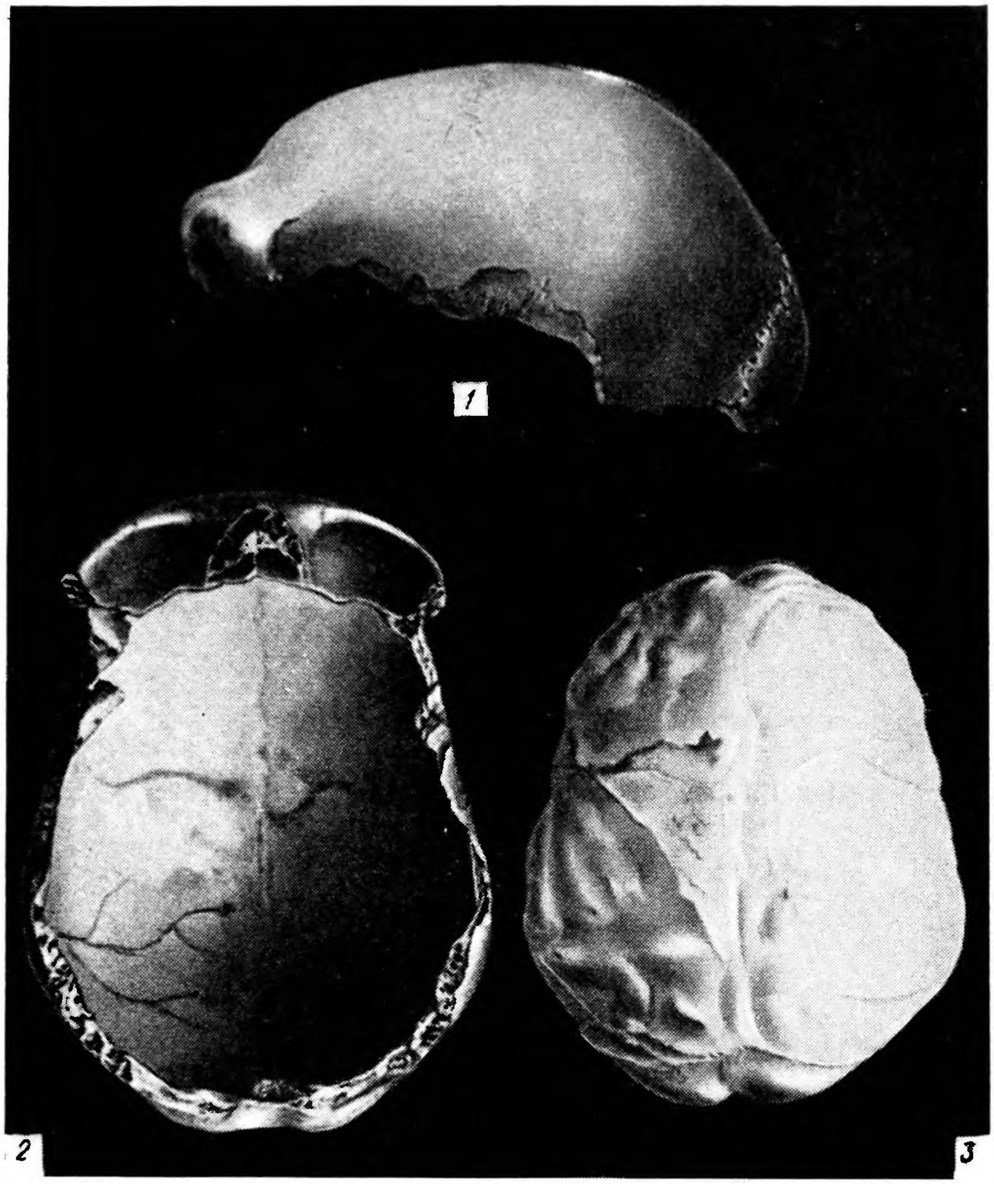


Fig. 120. Skull of Neanderthal man:
1—lateral and *2*—interior aspects; *3*—cranial cast. $^{1}/_{3}$ natural size. After Schaaffhausen, 1858.

2) an occipital region that seems to have been squeezed in the superior-inferior direction;
3) the squama of the temporal bone has a horizontal edge;
4) the styloid process is somewhat blunted;
5) flat cheek-bones sloping posteriorly;
6) the maxillary has no canine fossae that are typical of modern man;
7) a powerful mandible without a chin ridge (mental protuberance).
The cranial capacity of that skull was very great, about 1,600 c.c., which is much greater than the average for a Neanderthal skull.

Fig. 121. Skull of old Neanderthal man from La Chapelle-aux-Saints.

$^{1}/_{3}$ natural size. After M. Boule, 1952.

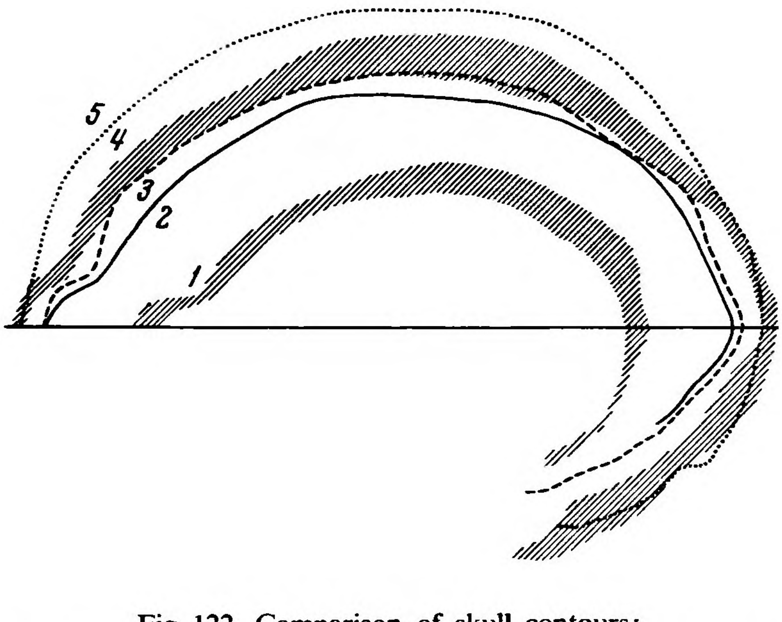


Fig. 122. Comparison of skull contours:

1—chimpanzee; *2*—Pithecanthropus; *3*—Sinanthropus; *4*—Neanderthaler; *5*—modern man (Cro-Magnon man from Combe-Capelle). After H. Weinert, 1936.

The size of the Neanderthaler's brain, therefore, was not less than that of modern man (fig. 122). The frontal lobes, however, were small and the brain, in general, had a number of points of resemblance with that of the apes.

The Neanderthaler had a skull of the long type, partly on account of the strongly developed supra-orbital ridge. The vault of the skull was very low. Some of the Neanderthaler skulls are closer to the modern type, for example, the skull from Ehringsdorf (Germany, 1914).

The numerous finds of Neanderthaler bone remains enable us to get a general picture of the type that preceded modern man. He was not tall, averaging about 160 cm. The length of the upper extremities as compared with the lower was somewhat less than that of a modern European.

The structure of the long bones of the Neanderthaler's lower extrem-

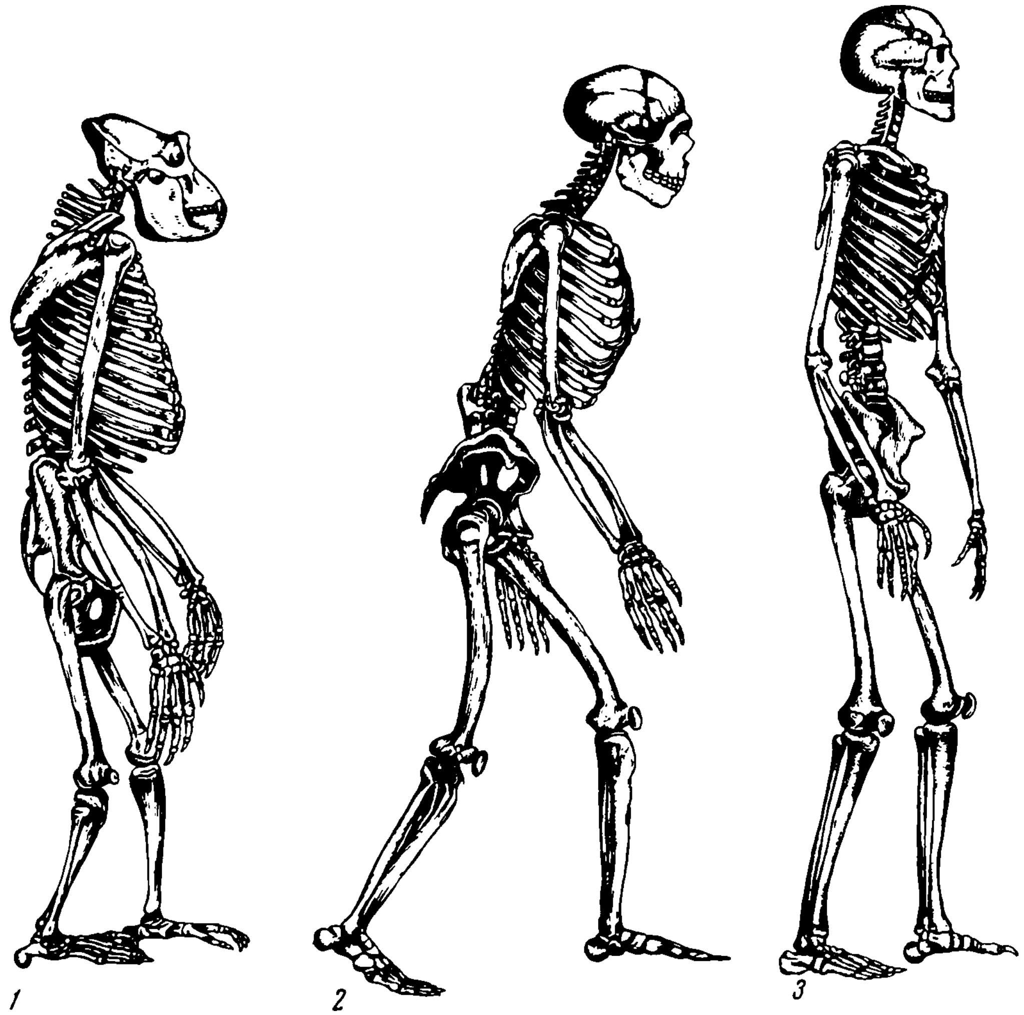


Fig. 123. Skeletons:
1—gorilla; *2*—Neanderthaler; *3*—modern man. After H. Raven, 1951 (*1*), after H. Weinert, 1936 (*2*) and after M. Gremyatsky, 1945 (*3*).

ities shows that the knee joints were not fully straightened. Their gait must have been clumsy which is confirmed by some other physical peculiarities. The curvature of the spine is much more poorly expressed than in modern man (fig. 123).

In 1921, in a cave at Broken Hill, Northern Rhodesia (Africa), the skull, sacrum, part of the left innominate bone, the femur and tibia of the left lower extremity of ancient man were found together with a large quantity of animal bones, mostly those of small mammals. This was a very important find, although its geological age has not been established (D. N. Anuchin, 1922, 1923). Nor has it been proved that the skull and skeletal bones belong to one individual.

The skull of the Rhodesian man (Woodward, 1921) has an extremely powerful supra-orbital ridge with developed lateral processes, a sharply sloping forehead and a low bony longitudinal ridge on the frontal bone; there is a transverse ridge on the occipital bone; the foramen magnum is nearer the centre of the base of the skull than in most Neanderthalers and resembles its position in modern man (fig. 124). The lower jaw was not found, but it was probably bigger than that of the Heidelberg man.

The cranial capacity was 1,325 c.c. Some scholars thought that the cranial cast of the Rhodesian man resembled that of the Pithecanthropus (O. Abel, 1931).

The Rhodesian man represents a form that combines very ancient features (the long skull, longitudinal ridge on the frontal bone, very high supra-orbital ridge, sharply sloping forehead) with those that are more progressive—the more forward position of the foramen magnum, the shape of the teeth that are close to those of modern man and the height (about 180 cm.). In general the Rhodesian man is a primitive form and his place in the Neanderthal group is today still not clear; the same may be said of his significance for the evolution of later hominids.

Some authors consider the Rhodesian man to be an ancestral type of the Negroid race, but there is no sound foundation for this assumption. It would be more correct to consider him one of the ancient African representatives of the Neanderthal stage of man's evolution that had already developed some features of transition to the type of structure typical of modern man. If we assume that the skull belongs to one individual and the skeletal bones to another, its antiquity becomes clearer. Some scholars are even of the opinion that the Rhodesian skull is so crude and massive that it must belong to an anthropoid of the gorilla type (M. M. Gerasimov, 1955). Much farther to the north, near Lake Niarasa (or Eyassi), to the south-east of Lake Victoria, the fragments of three Neanderthal skulls were found in 1932 (G. I. Petrov, 1941).

The best preserved skull was reconstructed by Weinert who found that it had many primitive features: a powerful supra-orbital and a high occipital ridges, the skull was widest in the region of the styloid processes, the foramen magnum was inclined posteriorly, as in the anthropoids. The capacity of the cranium was not large, only about 1,200 c.c.

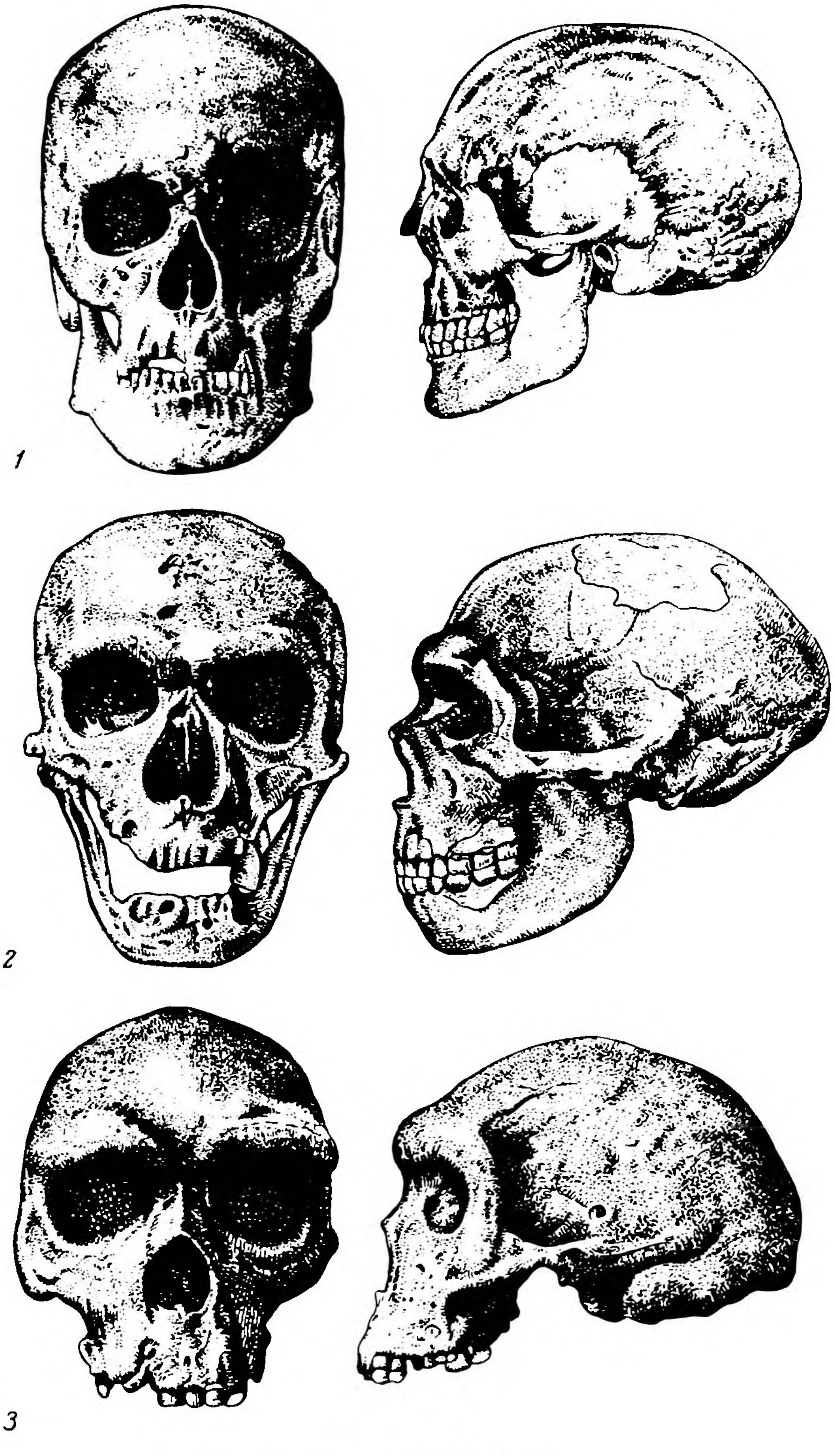


Fig. 124. Hominid skulls:

1—modern man; *2*—Neanderthaler from La Chapelle-aux-Saints; *3*—Rhodesian Neanderthaler from Broken Hill. Full-face and profile. $^2/_9$ natural size. (Profile *2* after J. MacGregor.)

Weinert calls this type an ape-man and the Niarasa man Africanthropus. G. F. Debets and other Soviet anthropologists consider that the reconstruction of the skull is inaccurate. It would be difficult to make an accurate reconstruction on account of the fragmentary nature of the finds. Many Soviet anthropologists believe the Africanthropus to belong either to the Neanderthalers or to a type that is intermediate between the ape-man and the earliest man.

The wide distribution of Neanderthal types throughout the Old World is exemplified by finds in Asia. The find of Neanderthaler remains on Java was of great importance in explaining the evolution of man in South-East Asia. In 1922 the Dutch geologist G. ten Haar was prospecting on the River Solo about 30 km. from Trinil, the place where the Pithecanthropus was found. He discovered the bones of many fossil animals—deer, swine, hippopotami, buffalos, rhinoceroses, crocodiles and stegodonts. In the same place he found fragments of the skulls of five ancient people (fig. 125). W. F. F. Oppenoorth later took part in the excavations and made the first description of the skulls. Among them was the well-preserved frontal bone of a child's skull (M. F. Nesturkh, 1932; M. A. Gremyatsky, 1936; Hans Weinert, 1933).

Fig. 125. Skull of Neanderthaler (Javanthropus) from Ngandong.
$^1/_3$ natural size. After W. Oppenoorth, 1937.

The skulls are very long. One of them is 221 mm. long, i.e., much longer than the average in modern man; the walls of the cranium are very thick and its capacity is about 1,000 c.c. This skull is called Ngandong I after the village near which it was found. Oppenoorth suggested that the owners of the skulls be called Javanthropi as they were found on Java.

Oppenoorth said that skull I is somewhat similar to the Rhodesian skull. The frontal region has a sharp slope but the vault is about 2 cm. higher than that of the Pithecanthropus. The transverse occipital ridge is well developed. The powerful supra-orbital ridge is typical and its extremely strongly developed ends are similar to those on the Rhodesian skull.

There are many features that approximate the Javanese Neanderthaler to the European specimens. The cranial capacity, however, is considerably smaller although skull I belongs to an old individual.

The Java man resembles the Pithecanthropus in having a long frontal bone and an elevation in the vicinity of the bregma, the junction of the coronal and sagittal sutures. He resembles modern man in having a well-expressed styloid process and very deep glenoid fossae to take the condyles of the lower jaw.

The Java skulls are of great antiquity. Oppenoorth and Keith say that the Java man lived somewhat later than the Pithecanthropus whose age they give as Late Pliocene. Osborn, however, seems to be nearer the mark when he computes the age of the Java man at 150,000 years and says that he lived in the third interglacial (Riss-Würm) epoch.

On the basis of his study of the skulls, Oppenoorth draws the following picture of the evolution of early man: the Java man was the ancestor of the Rhodesian man and the Australians, the Sinanthropi produced the Heidelberg man and through him the European Neanderthalers.

Oppenoorth's assumption is not convincing because the forms he mentions are territorially so far apart—the Rhodesian and Java men and the Heidelberg man and the Sinanthropi (M. F. Nesturkh, 1948).

The Sinanthropi could not have migrated as far as Europe. It would be safer to assume that in some region closer to Europe, somewhere near the borders of Asia and Africa, there developed simultaneously with the Sinanthropi groups of early men that were similar to them and from which the later forms developed, for example, the Heidelberg man, the European Neanderthalers, the Palestine Neanderthalers and the Rhodesian man.

Weinert, like Oppenoorth, believes that the Java man of Ngandong was the direct descendant of the Pithecanthropus and the ancestor of the Australians. This opinion cannot hold water because the Australians arrived on their continent in relatively recent times, some tens of thousands of years ago, and came from South-East Asia. In Soviet anthropology, since Y. Y. Roginsky's researches (1949), the polycentrism hypothesis has been opposed by that of monocentrism as applied to the problem of the origin of the modern type of man; monocentrism is based on the close genetic approximation of the physical structure of different groups of modern people, especially their skulls. We shall deal with these hypotheses at a greater length in a later chapter.

In the summer of 1938, when archaeologist A. P. Okladnikov was conducting excavations in the Teshik-Tash grotto near Baisun in South Uzbekistan (fig. 126) he discovered stone tools belonging to the Mousterian Epoch and the incomplete skeleton of an 8 or 9-year-old child (figs. 127-130). In the same place he found the remains of big fires and numerous bones and horns of the *teke* mountain goat that the Teshik-

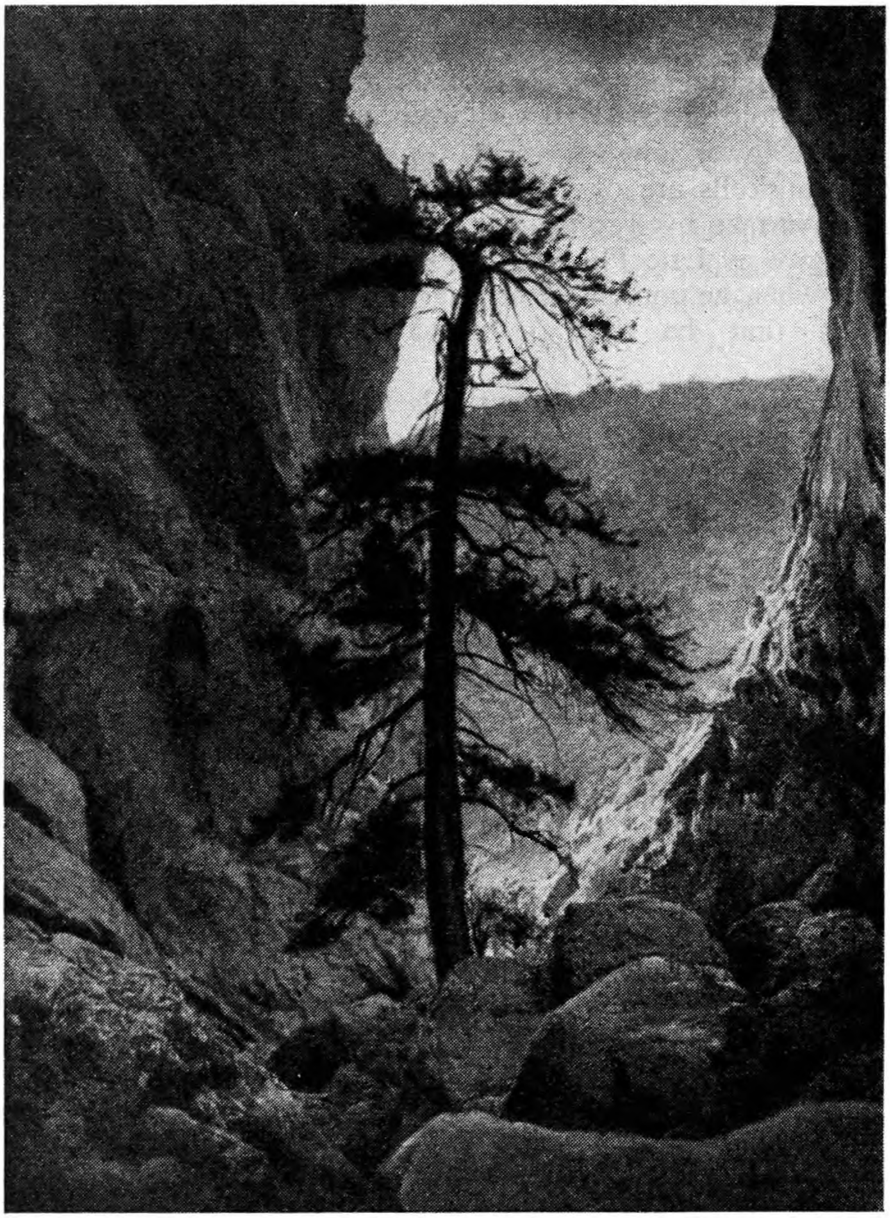


Fig. 126. Zautolosh-sai Gorge: near Teshik-Tash grotto.
After A. Okladnikov, 1949.

Fig. 127. Skull of Neanderthal child and the horns of a mountain goat on floor of Teshik-Tash grotto at the beginning of the excavation.
After A. Okladnikov, 1949.

Tash Neanderthalers apparently hunted (A. P. Okladnikov, 1940). Okladnikov sent the fossil bones of the child to the Moscow Institute of Anthropology where they were studied. The skull was reconstructed from a hundred and fifty fragments (fig. 131). This difficult job was done by M. M. Gerasimov, archaeologist and sculptor, who also produced the full reconstruction of the child shown in the photograph (fig. 132).

The first full study of the skull was made by G. F. Debets (1940). The cranial capacity is very great—1,490 c.c. If the Neanderthaler had reached maturity his brain would have been at least as big as that of the skull from La Chapelle-aux-Saints (1,600 c.c.). A description of the Teshik-Tash boy's cranial cast (V. V. Bunak, 1951) shows some signs of progression, a transition to a type of brain similar to that of modern man (fig. 133). On the forehead there are signs of a continuous but undeveloped supra-orbital ridge.

There is no chin ridge. All these features are typically Neanderthal but the teeth of the Teshik-Tash boy have small cavities, i.e., they are of the cynodontic type like those of the majority of modern people (M. A. Gremyatsky, 1948).

The find of the Teshik-Tash boy is of great scientific importance. It bears witness to the fact that the Neanderthaler lived about 100,000 years ago in the interior of the Asian continent in an environment that differed little from that of today. This area was little affected by the glaciation that made such tremendous changes in the North Asian area. Some scholars abroad, Hans Weinert, for example, give primary importance to the influence of the ice ages in the development of modern man from the Neanderthal type. The Teshik-Tash find, however, contradicts

Fig. 128. Skull of Neanderthal child *in situ* on raised ground of camping site; bones of skeleton in foreground.
After A. Okladnikov, 1949.

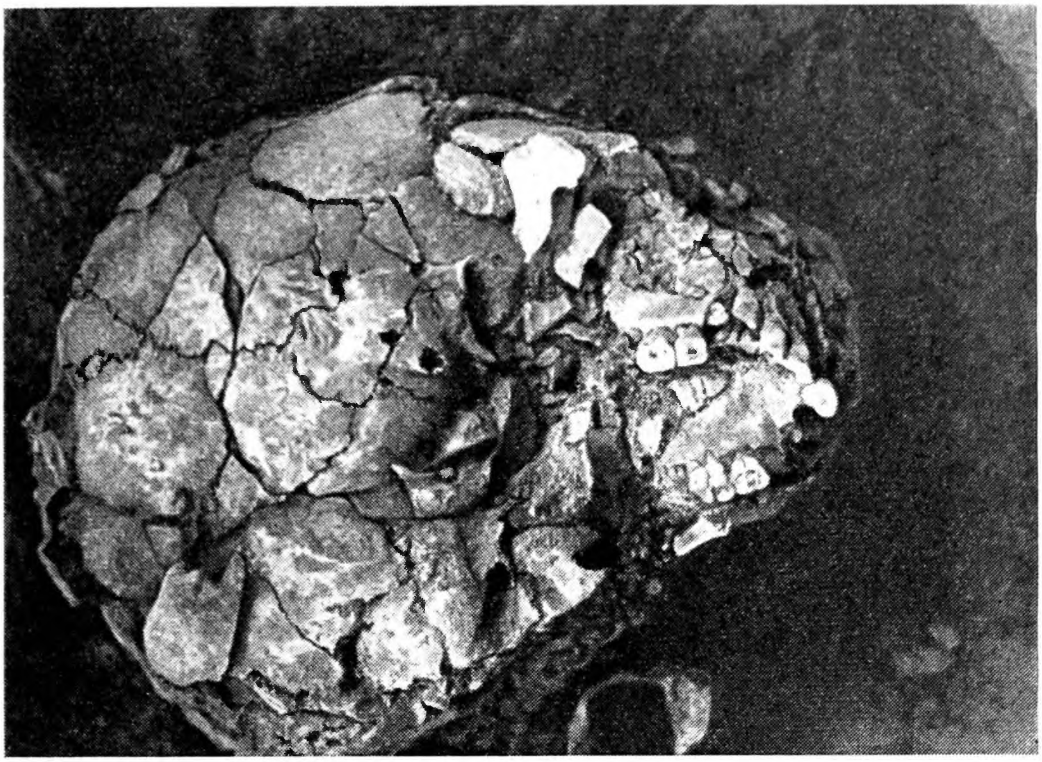


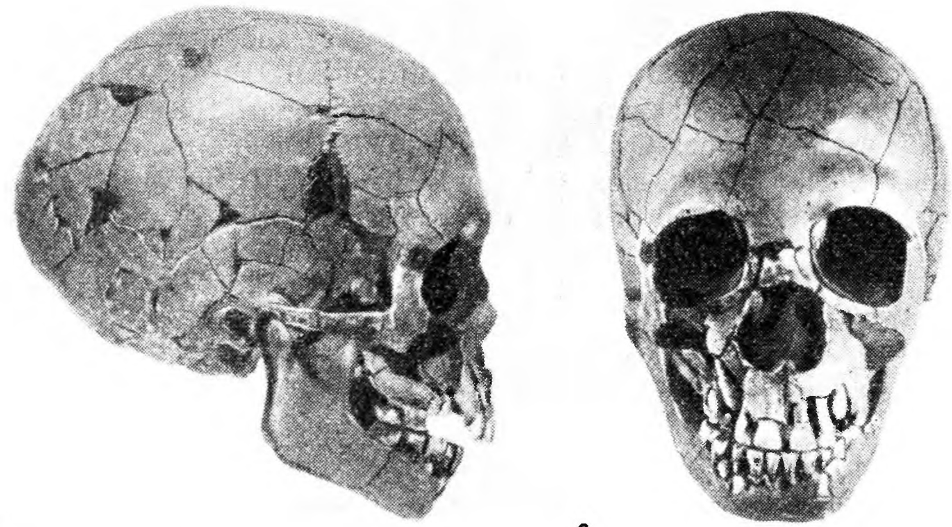
Fig. 129. Skull of Neanderthal child *in situ* in Teshik-Tash grotto; earth has been removed. After A. Okladnikov, 1949.

this opinion which, apart from that, is groundless because it is contradictory to the fundamental thesis of the decisive role played by social labour in anthropogenesis.

At an earlier date the fossil bones of a very ancient man were discovered in the Crimea. In 1924, in a grotto at Kiik-Koba, 25 kilometres east of Simferopol, the remains of a Neanderthal type of man were found by G. A. Bonch-Osmolovsky (1940, 1941, 1954); they consisted of the bones of a foot, shin and hand of an adult (figs. 134-135) and the incomplete skeleton of an infant. In various strata of the cave floor thousands of stone tools were found that, according to Bonch-Osmolovsky, belong to the amorphous and Late Acheulian stages of Early Palaeolithic culture. Bone tools were also discovered, one shaped like an anvil, for example. The discovery and description of the Kiik-Koba finds made a substantial contribution to the palaeanthropology of the Soviet Union.

The bones of the extremities of the Kiik-Koba man are of great interest. Bonch-Osmolovsky assumes from the fossil skeleton of the extremities that the Kiik-Koba man's hand (fig. 136) and foot were not so highly developed as those of modern man. Both he and V. V. Bunak consider that the structure of the Kiik-Koba extremities refutes the assumption that the ancestral form of man was an arboreal animal. They support

Fig. 130. Lower jaw from Neanderthal child's skull in Teshik-Tash grotto (*in situ*—during excavation).
After A. Okladnikov, 1949.



1 2

Fig. 131. Skull of Neanderthal child from Teshik-Tash grotto, reconstructed by M. Gerasimov.
$^2/_7$ natural size. After M. Gremyatsky, 1949.

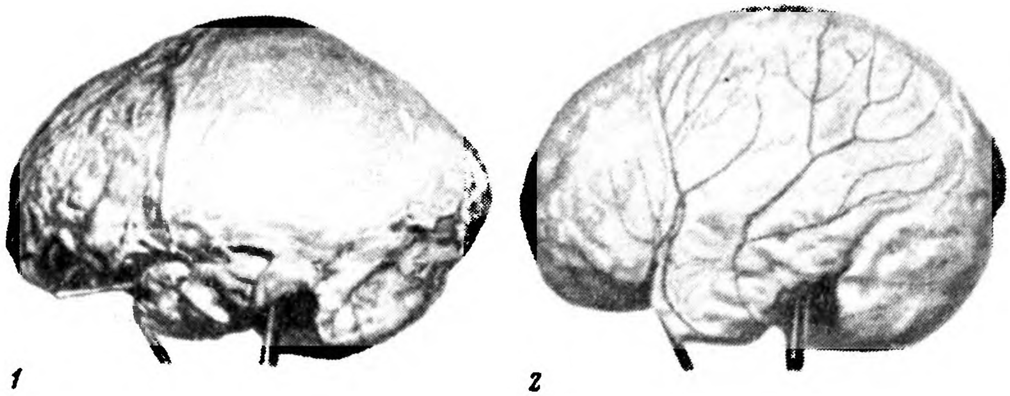


Fig. 132. Cranial casts:
1—Neanderthal child from Teshik-Tash grotto; 2—8-year-old modern child. 1/7 natural size. After V. Bunak, 1954.

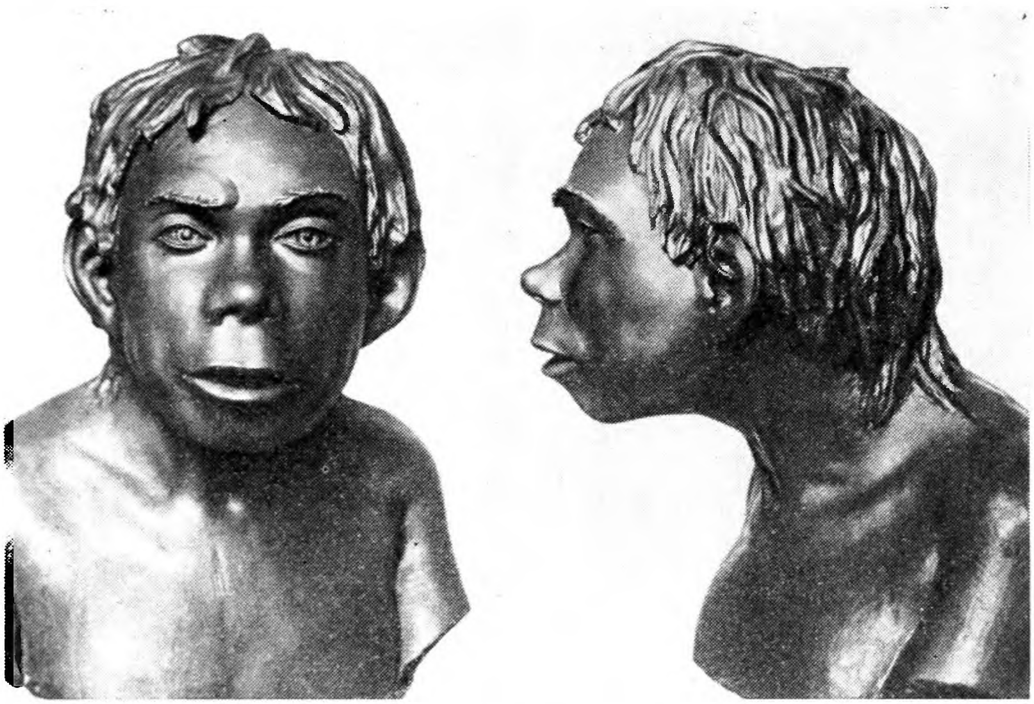


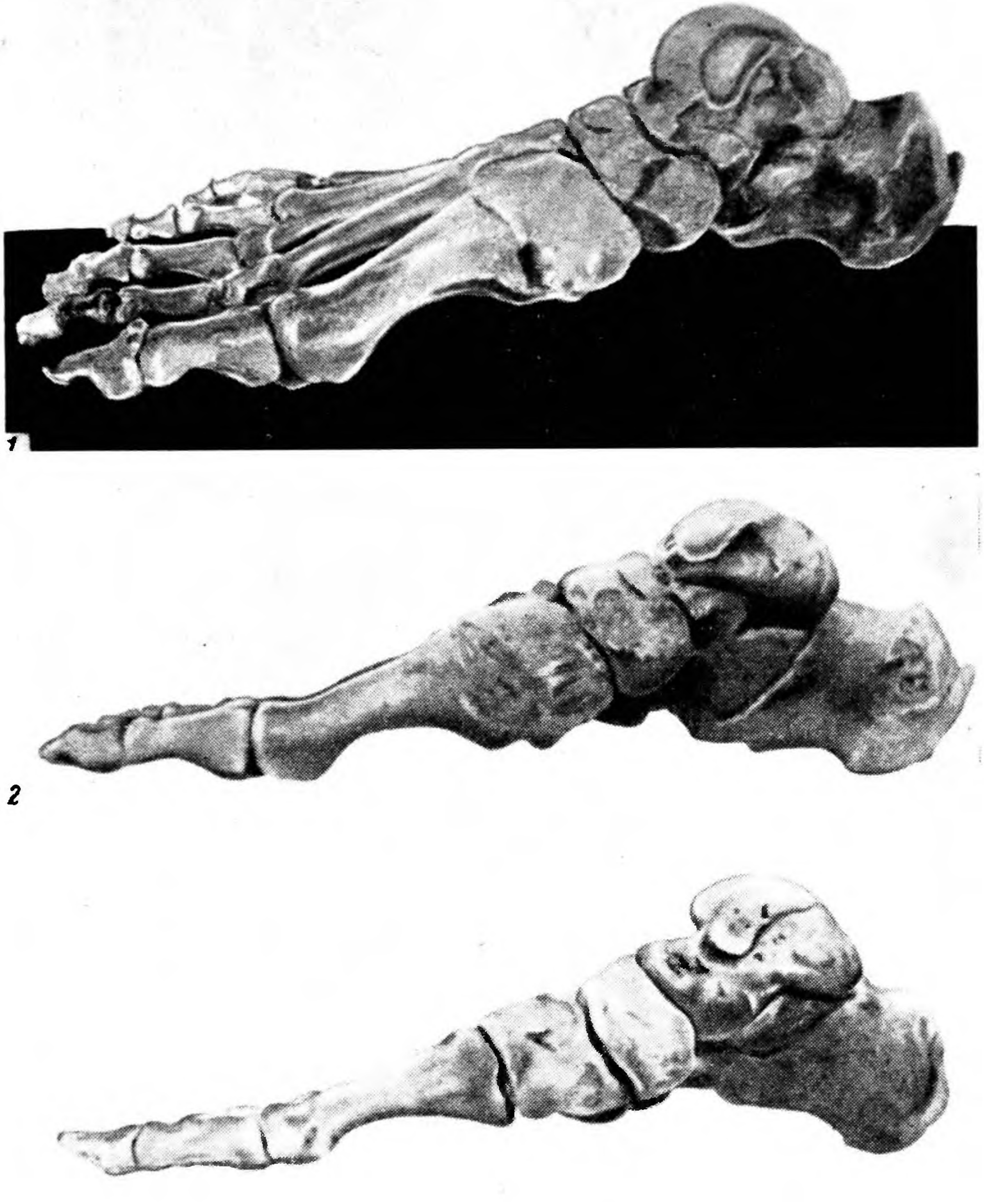
Fig. 133. Neanderthal child from Teshik-Tash grotto – reconstructed by M. Gerasimov. After M. Gerasimov, 1949.

their contention with a number of facts, among them the similarity of the Kiik-Koba hand and that of the human foetus.

G. A. Bonch-Osmolovsky's contention, however, is not sufficiently well grounded.

The determination of the geological age of the lower and upper strata of the grotto and their artifacts as Chellean and Acheulian is objected

Fig. 134. Right-hand skeleton of hominids:
1—Kiik-Koba man (reconstruction); *2*—modern man; dorsal aspect. 1/3 natural size. After G. Bonch-Osmolovsky, 1941.



1

2

3

Fig. 135. Assembled skeleton of right foot of hominids:
1, 2—Kiik-Koba man; *3*—modern man; medial aspect. About $^1/_3$ natural size (*1* and *2* reconstructed by V. Bunak, 1954).

to by some archaeologists and palaeontologists (O. N. Bader, 1940). As far as the refutation of the arboreal stage in the evolution of our simian ancestors by Bonch-Osmolosky (and V. V. Bunak, 1954) is concerned, there are too many proofs of the stage established by Darwin for it to be refuted by insufficient facts.

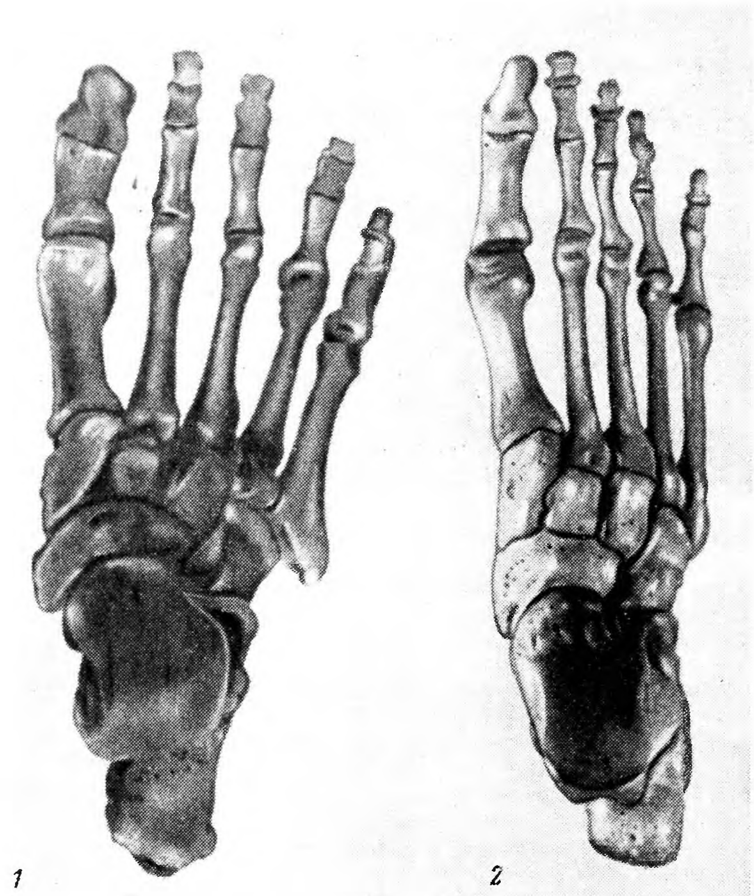


Fig. 136. Assembled skeleton of right foot of hominids:
1—Kiik-Koba man; *2*—modern man; dorsal aspect. $^1/_3$ natural size. After V. Bunak, 1954.

Suffice it here to recall the oblique head (caput obliquum) of the muscle abducting man's great toe. It is also typical for all monkeys and distinguishes them from other mammals. This is convincing evidence of the fact that among our ancestors there must have been arboreal forms with an anatomical structure similar to that of the monkeys. Many other facts to support this theory could be given. It is, however, possible that erect locomotion began to develop among man's ancestors in connection with cruriation much earlier than has hitherto been supposed.

4. THE PALESTINE NEANDERTHALERS

The Palestine Neanderthalers belong to the group of fossil hominids whose anatomical structure places them among the types showing transition to modern man. Between 1931 and 1936, near the towns of Haifa and Athlith the skeletal remains of almost twenty Neanderthalers, the skeleton of a child among them, were found in the es-Skhul and et-Tabun

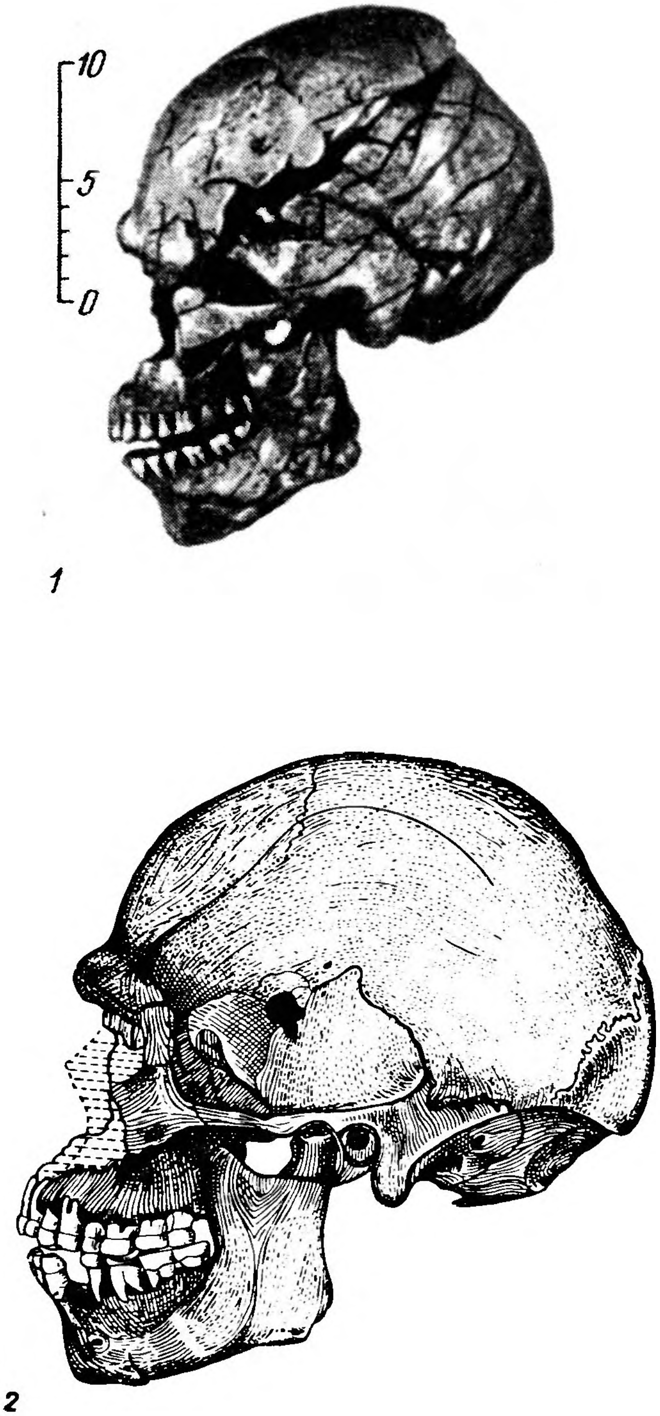


Fig. 137. Neanderthal skull:

1—skull from cave Skhul V on Mount Carmel; *2*—its reconstruction. About $^{1}/_{5}$ and $^{1}/_{3}$ natural size. After Th. McCown and A. Keith, 1939.

caves on the slopes of Mount Carmel (M. F. Nesturkh, 1940; G. I. Petrov, 1941).

Several skeletons were found in the es-Skhul cave indicating what was apparently a collective burial. The majority of the skeletons were found in 1932 by the American scientist Theodore McCown who demonstrated some of his finds at the World Congress of Archaeologists held in London that same year.

The tremendous interest aroused by these finds was fully justified by their quantity. It was, furthermore, shown by later investigations that the Palestine skeletons showed some features that throw light on the transition from the Neanderthal to the modern type.

The specific features of the Palestine folk are clearly seen in the skeletons of adults from the es-Skhul cave. They were tall and their thigh bones were, as a rule, straight. The skull (fig. 137) had a strongly expressed supra-orbital ridge which McCown even called "umbrella-shaped." The mandible is heavy, powerful and wide.

Contrary to the mandibles of typical Neanderthalers, however, some of them have a small chin ridge which brings the Palestine man closer to modern man. Such an approximation to modern man is justified, furthermore, by a higher and rounder cranial vault and more highly developed perietal and frontal regions than are common among Neanderthalers. The teeth, however, resemble the Neanderthal type. Nevertheless, the molars have a small cavity so that they are not of the taurodont type with the exception of some similarity in the roots. The skull seems to have had a very powerful musculature attached to it. There is a transverse occipital ridge to which the cervical muscles were attached.

The majority of the skeletons, including that of the child, were found with the knees drawn up to the body. Stone tools found with them showed that these people were at the Mousterian stage of cultural development.

McCown, collaborating with Keith, gave a very detailed description of the skeletons, individual bones and skulls in a special monograph (1939). The archaeological aspect of the find was described by Dorothy Garrod and D. A. E. Bate (1937).

The skeletal remains that mostly interest us were taken mainly from the small es-Skhul cave, although some of them were found in the bigger et-Tabun cave. They were discovered and excavated by Dorothy Garrod, who headed the expedition.

In the es-Skhul cave, in breccia as hard as stone, were found: the almost complete skeleton of a child, apparently a girl of about $4^1/_2$ years; part of four skeletons, two male of 30-35 and 50 years, one female 35-50 years and a child, most likely a boy, 8-10 years; fragments of the skull, teeth and separate bones of an adult male, a female 30-40 years and a child, probably a boy, $5\text{-}5^1/_2$ years and 16 separate bones (figs. 138-139).

From the ground of the et-Tabun cave were removed: an almost complete skeleton of a female about 30 years of age, an almost complete

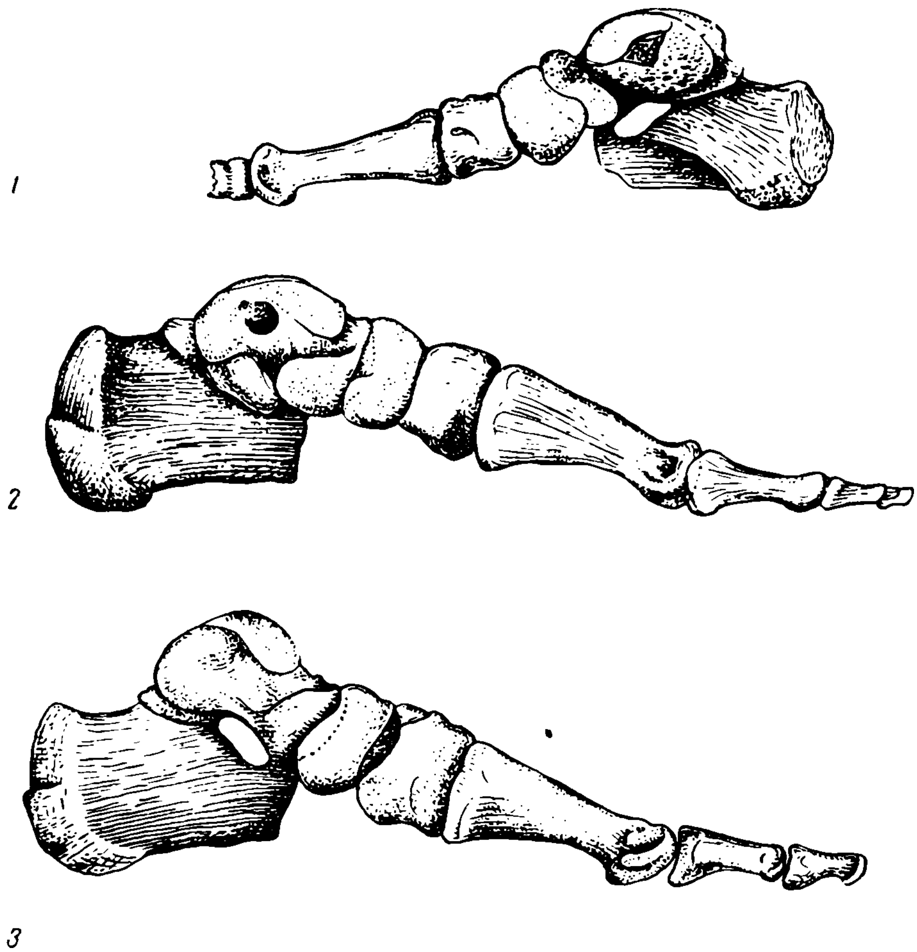


Fig. 138. Skeleton of Neanderthal foot:
1—Tabun I; *2*—Skhul IV; *3*—modern man. $^1/_3$ natural size. After Th. McCown and A. Keith, 1939.

mandible of a male, 30-35 years, with the teeth in their sockets, three series of bones (among them the diaphysis of the right femur) and teeth (among them the first and second lower molars); all were taken from the upper stratum of the Chellean Epoch.

The two caves, therefore, contained the remains of 23 individuals of different ages and sexes. The skulls were well preserved on three skeletons from the es-Skhul cave, and on the female skeleton from the et-Tabun cave (fig. 140). The removal of the remains from the rock, their consolidation with special binding materials, the building of each skeleton from its component parts, comparison with other fossil bones, the measurement, description, analysis and comparison of the bones with each other and with other Neanderthal finds and with the bones of modern man—all this work was done with great thoroughness and provides a very clear picture of this important discovery.

A rather special place among the finds is held by the female skeleton from the et-Tabun cave as its skull has very obvious Neanderthal features and is, in general, similar to the female skull Gibraltar I (found in 1848).

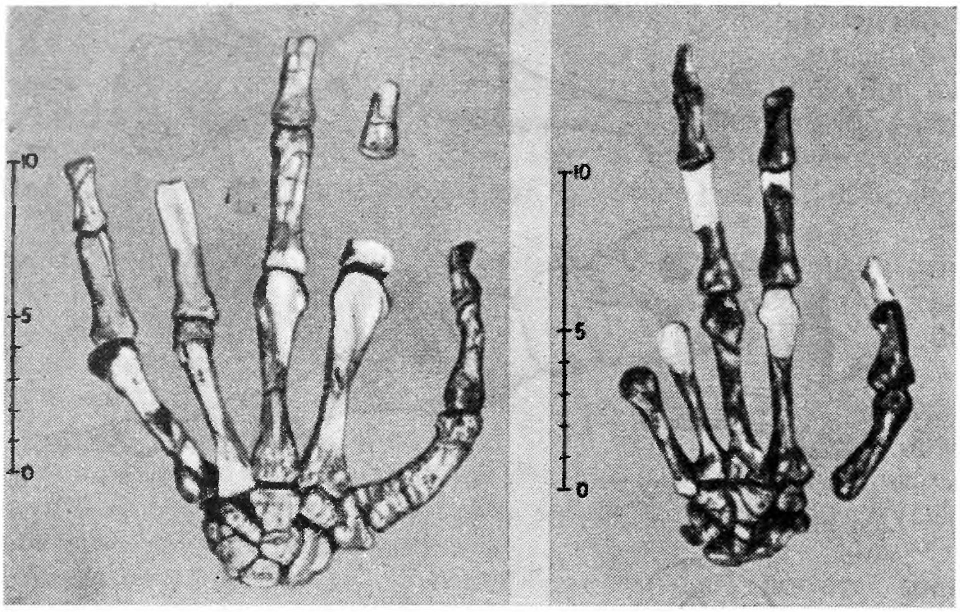


Fig. 139. Skeleton of Neanderthal left hand:
1—Tabun I; *2*—Skhul V; dorsal aspect. $^{3}/_{7}$ natural size. After Th. McCown and A. Keith, 1939.

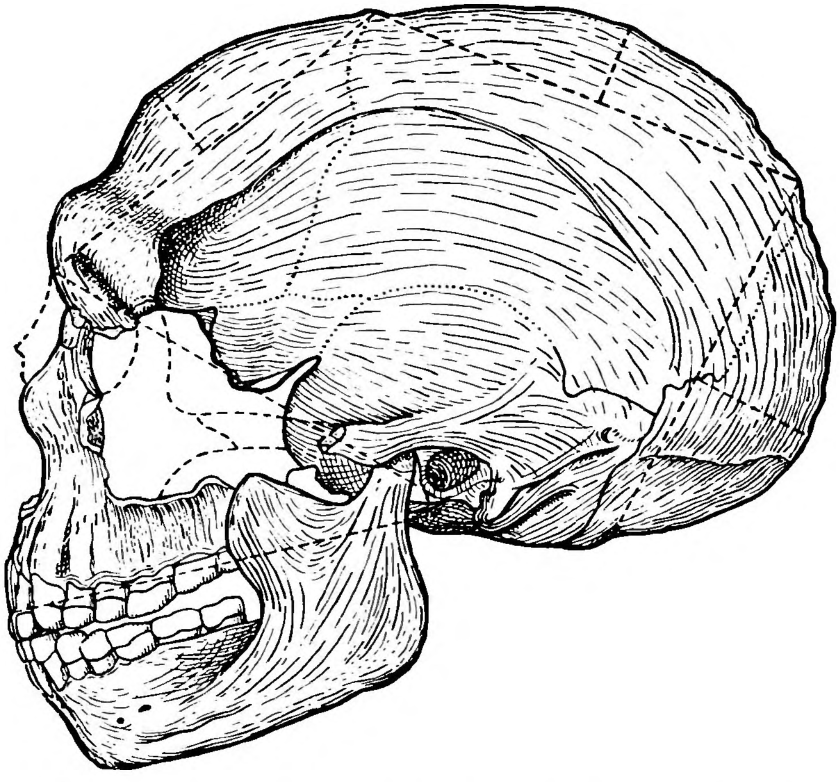


Fig. 140. Woman's skull from Tabun cave (reconstruction).
$^{2}/_{5}$ natural size. After Th. McCown and A. Keith, 1939.

In 1925, in the cave of el-Zuttiye, Galilee, about 85 km. to the north-west of Mount Carmel, the fragment of a human skull (fig. 141) was found which McCown and Keith believe belongs to the same race of Palestine men.

Fig. 141. Neanderthal skull fragment from Mughareth el-Zuttiye, north-east bank of Lake Gennisareth, Galilee.
About 1/2 natural size. After Th. Mollison, 1932.

The skeletal remains from the es-Skhul cave, in their shape and structure constitute a mixture of Neanderthal and Cro-Magnon features never found elsewhere before or since.

The two types, however, both es-Skhul and et-Tabun, belong to practically the same phase of the Levalloiso-Mousterian cultural epoch (the fauna that accompanies them is, in general, similar, although the bones of oxen predominated at es-Skhul and the bones of gazelles at et-Tabun). We may assume that the Palestinians discovered in the Mount Carmel caves represent a single group with strongly pronounced individual mutations, possibly conditioned by the mixed character of the cave dwellers.

The authors of the above-mentioned monograph, in their characterization of the es-Skhul Palestinians, found that the frontal region of the skull, the teeth and the vertebral column show Neanderthal peculiarities, while the length of the trunk and the nature of the extremities give them a resemblance to Cro-Magnon types. The height of the men, in two cases, proved to be 170 and 178 cm. The women are much shorter than the men and belong to the short or medium type. Cro-Magnon women are closer to medium height than short. The vertebral column shows some Neanderthal features and the lower extremities are long. The head is big. The cranial capacity of the three adult male skulls varies between 1,518 and 1,587 c.c. The female skulls from the es-Skhul cave have capacities of 1,300-1,350 c.c. and that from the et-Tabun cave has 1,270 c.c., i.e., in general the same capacities as those of the Cro-Magnon women's skulls.

The es-Skhul skulls are very long dolichocephalic types with an index well below 75, while that from et-Tabun is of medium length, mesocephalic, with an index of 77. The majority of Cro-Magnon skulls are dolichocephalic. The es-Skhul skulls have vaults of average height and in this respect occupy an intermediate place (for the new reconstruction of skull Skhul V see Snow's paper, 1953).

The casts of the cranial cavities show that the brain is very similar to the Cro-Magnon type in shape and in its general dimensions, although the pattern of gyri and sulci is somewhat simpler.

The forehead is moderately convex, the orbits are wide but not high (in the majority of Cro-Magnon skulls they are very low). There is a supra-orbital bony ridge with noticeable divisions into medial and lateral parts. This division was complete in the Cro-Magnon people.

The majority of the Palestine skulls from es-Skhul have a facial region that does not greatly protrude, the face being orthognathous and of average length like that of the Cro-Magnon types. The es-Skhul V skull, however, is very definitely prognathous. The canine fossae on the maxillary are absent, the superior edge of the zygomatic bone is thickened and the nasal region varies both in the extent to which it protrudes and in the width of the nasal foramen.

Now let us look at the mandible. It varies both in size and massiveness; large and small jawbones were found, the smaller being the more massive while the large are much thinner. The rami are very wide, like those of the Neanderthalers and some of the Cro-Magnon types. The angle of the mandible is weakly developed in some, as in the Cro-Magnon skulls, but in others it is strongly developed. The chin ridge is either absent or slightly developed, but in the Cro-Magnon skulls it is moderately or well developed. Lastly, the teeth of the Palestine skulls are moderately big or as big as those of the Neanderthalers (the Cro-Magnon types are moderately big). The pattern on the grinding surfaces of the molars has more primitive features than those of the Cro-Magnon types.

McCown and Keith found as a result of their analysis of the chief points of comparison that the inhabitants of the es-Skhul cave possess only three significant features in common with the Neanderthalers: the supra-orbital ridge, the flattened cheek-bones and the pattern of the teeth. There are 8 points of similarity with the Cro-Magnon type and 12 points of an intermediate character. To these the authors of the monograph added 86 features of lesser significance, with the result that out of a total of 111, only 16 features were common to the Palestine type and the Neanderthalers, 32 allied them to the Cro-Magnon man (and even to the Neanthropus), 48 were of an intermediate character, 13 were undefined and 4 showed points of specialization.

From these details we see that there was a deviation, and a very substantial one at that, in the direction of the modern type of man. Nevertheless, McCown and Keith, who regard the supra-orbital ridge and other specific structural features of the skull, teeth and skeleton, as being of the greatest importance, place the Palestine remains in the Neanderthal group as a special link between them and people of a modern type.

McCown and Keith, however, regard this link as being phylogenic in character and assume that the Neanderthalers and modern man are descendants of a common ancestor, the Pithecanthropus. It is our opinion that the Palestine folk are undoubtedly a stage in the development from

the Neanderthal type to the Cro-Magnon type (in the broadest sense of that conception).

A significant anatomical feature that distinguishes the Neanderthal type is the absence of a chin ridge. And precisely in the Palestine types we see the transition from the chinless skull to that with a chin: this mixture of the anatomical features of modern man with those of the Neanderthaler makes it necessary to consider them a transitional type. Since the features typical of modern man predominate, some scholars have expressed the opinion that the Palestine folk were the first real men, the oldest representatives of *Homo sapiens*.

In any case the Palestine discovery is one of the most outstanding events in the sphere of anthropogenesis during the past few decades. It is as important as the discovery of the Neanderthal type in Java, or even the discovery of the Peking man, the Sinanthropus. It is also noteworthy that the intermediate type was discovered in Palestine at the juncture of three continents, Europe, Asia and Africa, and that the fossil remains have features of resemblance not only with the Neanderthalers, but also with the Cro-Magnon folk of Europe.

The discovery of the fossil remains of Neanderthalers and other forms similar to them over such an extensive territory of the Old World gives us every reason to suppose that the Neanderthal types were the ancestors of modern man. It would be difficult to imagine that such a numerous population of Neanderthalers could have become absolutely extinct and have left no trace, since their hordes could have fought successfully for their existence under conditions of increasing cold, could have hunted animals, kept fires burning and have lived in stable primitive groups.

The Neanderthal physical types (figs. 142-143) were such that could, in the majority of cases, have been the predecessors and ancestors of modern man. It would, indeed, be difficult to conceive any other way in which the modern type could have had its origin. One would have to assume that man first originated, say, in a small district in Asia and from there spread rapidly over the whole territory of the Old World; that, however, involves the theory of primitive man's migration that nobody now supports.

Later works are now more and more supporting the hypothesis first postulated by the progressive American anthropologist, Aleš Hrdlička in 1927, that the Cro-Magnon developed from the Neanderthal man.

The hypothesis is supported by some other finds that have been made since that time in Europe and Asia (M. F. Nesturkh, 1937; M. A. Gremyatsky, 1948). In 1933, for example, a female Neanderthal skull with small cranial capacity and a heavy supra-orbital ridge was found at Steinheim, near Stuttgart, in Germany. The foramen magnum is almost in the same position as that of modern man (G. F. Debets, 1934; G. I. Petrov, 1940). The upper margin of the temporal squama is not horizontal, like those of most Neanderthalers, ape-men and apes, but is rounded like that of modern man.

Fig. 142. Fossil men:
1—Sinanthropus; *2*—Neanderthaler. Reconstructed by M. Gerasimov, 1948.

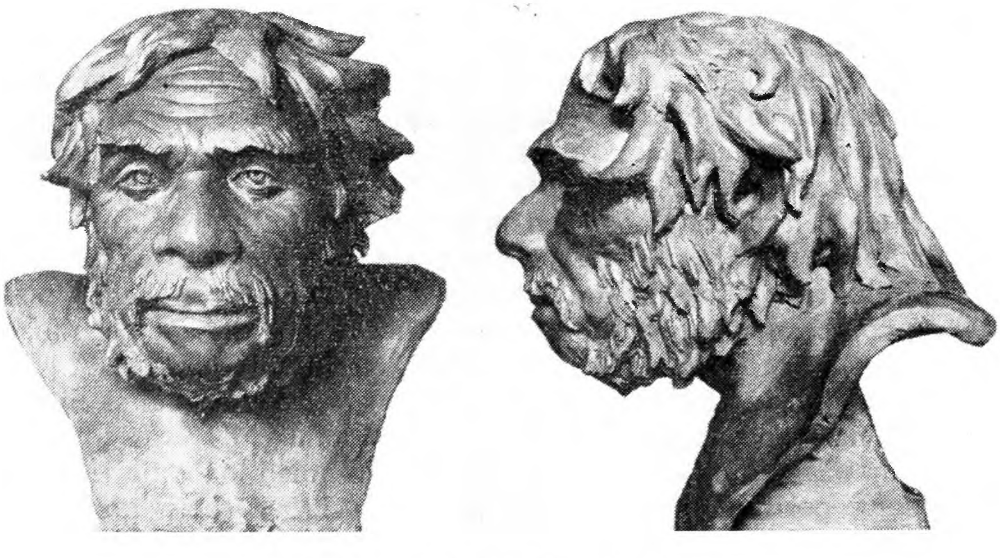


Fig. 143. Neanderthaler, full-face and profile.
Reconstructed by M. Gerasimov, 1948.

M. A. Gremyatsky (1948) proposed the classification of Neanderthal remains into two generalized types—those that were ancestral to modern man and those that showed specialized, "European" characteristics. More recent ideas on the necessity for a classification of this extensive and variegated group of the immediate ancestors of *Homo sapiens* have been based on this conception, but include other Neanderthal remains that bear clear evidence of the descent of the modern type of man from the primitive type (V. P. Yakimov, 1949).

The morphological peculiarities of fossil representatives of mankind indicate that the modern physical type passed through three stages in the course of its formation. It is our opinion that the Hominidae family contains only one genus, Homo, represented by three subgenera that constitute three stages in man's development (M. F. Nesturkh, 1941; see, however, article by G. F. Debets, 1948).

The first subgenus is the Pithecanthropus; it includes two well-expressed and well-represented species of primitive man. They are:

1) the Java or Trinil ape-man, Homo (Pithecanthropus) erectus;

2) the Peking ape-man, or Sinanthropus, Homo (Pithecanthropus) pekinensis.

The second subgenus is that of Palaeanthropus, or early man, grouped around the Neanderthal type. To this subgenus belong, for example, the West-European Neanderthalers, Rhodesian man, the Palestine Neanderthalers, the ancient Java man, altogether several species or subspecies.

The third subgenus is that of the new man, Neanthropus, that includes fossil types of modern man, such as the Cro-Magnon type, and the living types. All these belong to one species—Homo (Neanthropus) sapiens.

5. PRIMITIVE MAN'S WAY OF LIFE

Many Neanderthalers lived in caves that protected them from cold during the ice age. The bones of the cave bear, lions and hyaenas have often been found together with the fossil remains of Neanderthalers. This shows that primitive man had to contest with wild animals for a dwelling. The remains of other animals, the mammoth and rhinoceros among them, show the extent of the chase; hunting became especially intensive in the Mousterian Period. Earlier hordes of people had lived chiefly by gathering fruits and roots and trapping small animals.

The Mousterian folk hunted not only in open country, but also in the forests, giving chase mainly to animals of medium size. They often hunted the bigger animals collectively, killed young, defenceless, very old or sick animals that had fallen into pits and swamps and also ate carrion.

When the Neanderthalers had killed an animal they used stone tools to remove the skin, take the meat off the bones, break the long bones to obtain the nutritious bone marrow and crack the skull to get the brains for food. The meat was either eaten raw or roasted over a fire.

It is most likely that the Neanderthalers used the skins of animals to cover their bodies and to sleep on (P. P. Yefimenko, 1933; H. F. Osborn, 1924).

The hunting economy of the Mousterian Epoch involved considerable technical and organizational progress. There was a further division of labour and the most experienced hunters became the leading members of the primitive human horde. Although the European Neanderthalers were quite well adapted to life, even in the harsh conditions of the Mousterian Epoch it seems likely that disease and the strenuous struggle for existence made them short-lived (G. I. Petrov, 1928).

The life of primitive man was, in general, one of danger, disease and privation. An estimate of this distant period when man was taking shape we find in Lenin's words: "The story that primitive man obtained all his requirements as a free gift of nature is a silly fable.... Our age was not preceded by a Golden Age; and primitive man was absolutely crushed by the burden of existence, by the difficulties of fighting against nature."*

Neanderthalers made better stone tools in greater variety than those of the preceding epochs (fig. 144). The implements of the pre-Chellean cultures were much simpler than the chisel-shaped celts, or hand cutters of the Late Chellean folk.

The Chellean celts were made by breaking a piece off a block of native flint in such a way that one end would be sharp and serve as the cutting or striking edge while the other, blunt end, would serve as a handle that could be grasped in the clenched fist (fig. 145). Other types of tool are also known to have existed in the Chellean Epoch.

The Acheulian culture employed more symmetrical implements, the whole surface of which was treated by chipping; this was a completely new technique. In this epoch tools made from pieces of flint broken from the native rock are also found but they are really typical of the later, Mousterian, Palaeolithic culture.

Most typical of the Mousterian Epoch are stone scrapers and spear-heads made from splinters and not from the stone block.

The tool-making technique of the Mousterian Epoch was, judging by European archaeological discoveries, very different from that of the Acheulian.

The shape and size of ancient implements frequently enable us to judge their uses with fair accuracy. Tools are often found together with animal bones that have been cracked in the length or broken across and near them remains of a fire and of human bones. The tools used by primitive people and other evidence of their activities enable us to draw some very important conclusions about the life they led and about the level of their social and economic development.

---

* V. I. Lenin, *The Agrarian Question and the "Critics of Marx,"* Moscow 1954, pp. 11-12.

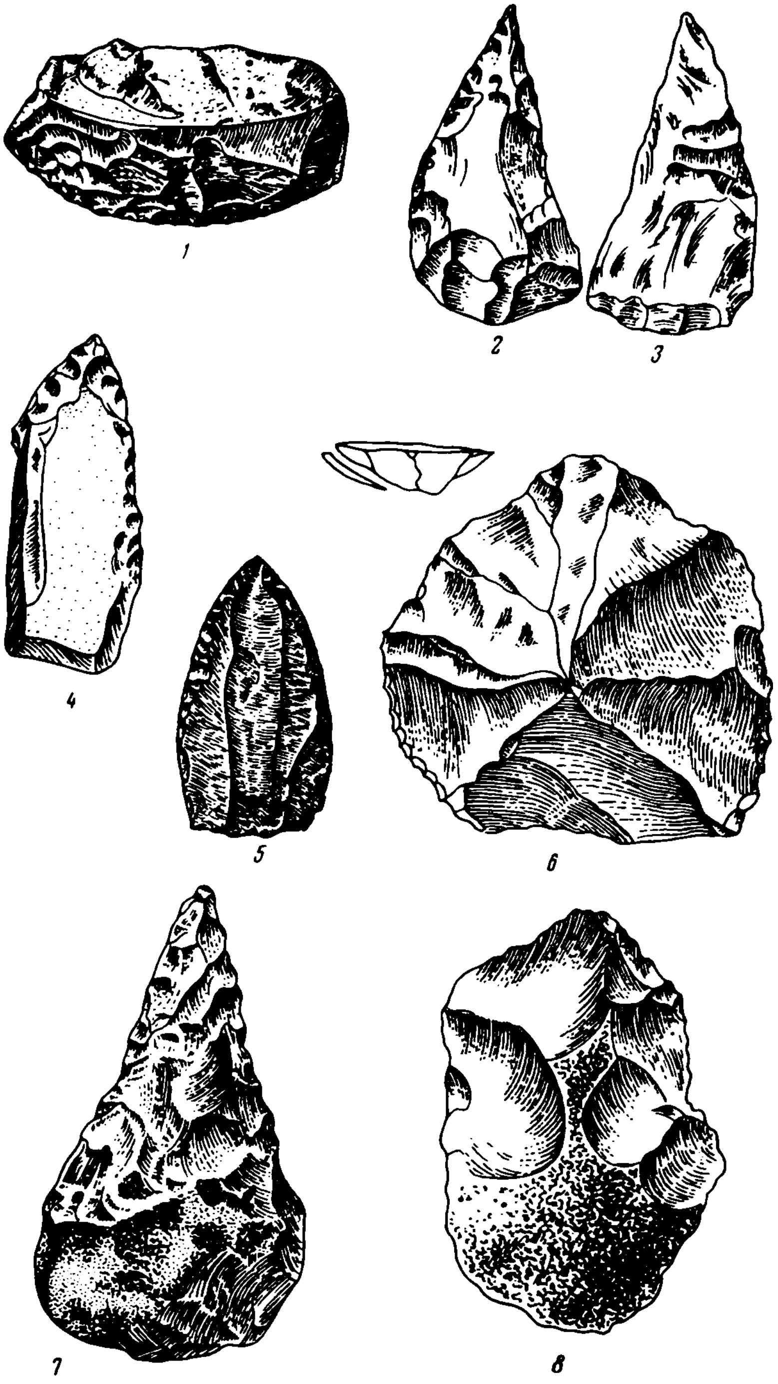


Fig. 144. Stone implements of Middle Palaeolithic:

1—Mousterian scraper, France; *2*, *3*, *4*—two stone celts from Kiik-Koba grotto, Crimea; *5*—Mousterian celt, France; *6*—Mousterian disc-shaped quartzite nucleus from camping site on River Derkul, Donets Basin; above—method of splitting layers from nucleus; *7*—flint striking tool, Acheulian type (England); *8*—Chellean striking tool of an early type (Belgium). Dimensions of implements: *1*—70 mm.; *2*, *3*, *4*—natural size; *5*—74 mm.; *6*, *7*—$^1/_3$ natural size; *8*—about $^1/_5$ natural size. After H. Mortillet, 1910 (*1*, *5*) and P. Yefimenko, 1953 (*2*, *3*, *4*, *6*, *7*, *8*).

Fig. 145. Neanderthaler.
Reconstructed by N. Sinelnikov and M. Nesturkh, drawn by S. Obolensky, 1941.

Marx says: "Relics of bygone instruments of labour possess the same importance for the investigation of extinct economic forms of society, as do fossil bones for the determination of extinct species of animals. It is not the articles made, but how they are made, and by what instruments, that enables us to distinguish different economic epochs."*

Not only men but also women, naturally, took part in the social labour of the primitive horde. The way in which they participated was, apparently, different, because the anatomical and physiological specifics of the woman obviously prevented her from taking part, with the same ease as the man, in the hunting of big animals, on account of the lengthy and rapid chase. It was also more difficult for a woman to throw stones and struggle with a wild beast.

It was not only the chase but other features of the life of primitive people that necessitated the division of labour between men and women. This agrees completely with the following postulate of Marx: "Within a family, and after further development within a tribe, there springs up naturally a division of labour, caused by differences of sex and age, a division that is consequently based on a purely physiological foundation, which division enlarges its materials by the expansion of the community, by the increase of population, and more especially, by the conflicts between different tribes and the subjugation of one tribe by another."**

As collective activity and social relations became more complicated, even in the primitive Neanderthal horde, they had a progressive influence on the development of the brain and of a new method of communication to replace the inarticulate sounds that were typical of the first hominids or ape-men. This new mode of communication was articulate speech that probably began to take form among the Neanderthalers (if not among the Sinanthropi), but reached full development only in Cro-Magnon times.

Many scholars regard the Cro-Magnon stage of human development as being the one in which early, fantastic conceptions of natural forces and, later, of social forces had their inception, such, for example, as were connected with hunting, witchcraft or magic and which later became embryonic religions. Engels said of the birth of religion: "All religion, however, is nothing but the fantastic reflection in men's minds of those external forces which control their daily life, a reflection in which the terrestrial forces assume the form of supernatural forces. In the beginnings of history it was the forces of nature which were first so reflected, and which in the course of further evolution underwent the most manifold and varied personifications among the various peoples.... But it is not long before, side by side with the forces of Nature, social forces begin to be active...."***

* K. Marx, *Capital*, Vol. I, p. 179. Moscow 1954.

** *Ibid.*, p. 351.

*** F. Engels, *Herr Eugen Dühring's Revolution in Science*, Moscow 1954, p. 438.

The finds of Neanderthal burials in caves led a number of scholars to speak of the cult burials of these folk, but they have been severely criticized (see articles by A. P. Okladnikov and P. I. Boriskovsky, 1956, and M. S. Plisetsky, 1957).

6. THE DEVELOPMENT OF FOSSIL MAN'S BRAIN

Modern man's brain is one of the most important results of the development of hominids as social beings fabricating instruments of labour. In human society, from its very earliest stages, those mental abilities of the individual that proved of benefit in his own life and in that of society began to occupy a more and more prominent place.

Not only the process of tool-making but also the use of tools was significant in determining man's evolutionary path. Labour, articulate speech and collective hunting all helped the survival of individuals with the most highly developed brain.

The brain of the Pithecanthropus was already one and a half times the size of that of the gorilla and its relative weight must have been three or four times greater. In the course of 500,000 years the brain of the ape-men developed into the Neanderthal brain which, in size and weight, more closely approximates that of modern man (fig. 146).

The Neanderthal brain, however, had a much more primitive structure than that of modern man, as may be judged from the poorly-developed frontal lobes.

Labour had a progressive influence on the development of the brain. The great stimulus of labour still did not exist in the ape herds of our ancestors. It made its appearance in the hordes of ape-men and under the influence of social labour activities the brain began its intensive development and increased in size.

The average cranial capacity of the Java Pithecanthropi was about 900 c.c., the Peking man (Sinanthropus) had an average capacity of 1,050 c.c. while that of the Neanderthal cranium was 1,300-1,400 c.c., i.e., the cranial capacity was almost the same as that of modern man. It follows from this that in the course of about two-thirds of the Quaternary Period the volume of the brain increased by 400 c.c. which is equal to an increase in size that, among the ancestors of the hominids, must have taken a considerably longer period—from the time of the peak of Dryopithecus development up to the appearance of the first men.

The rate of cerebral development from the Pithecanthropus to the Neanderthaler must have been very intensive both absolutely and relatively, although there was comparatively little change in primitive techniques and primitive forms of human society in those same hundreds of thousands of years.

The newness and the powerful influence of labour on the human organism, however, produced such rates of cerebral development as had never before occurred and never could have occurred in any other

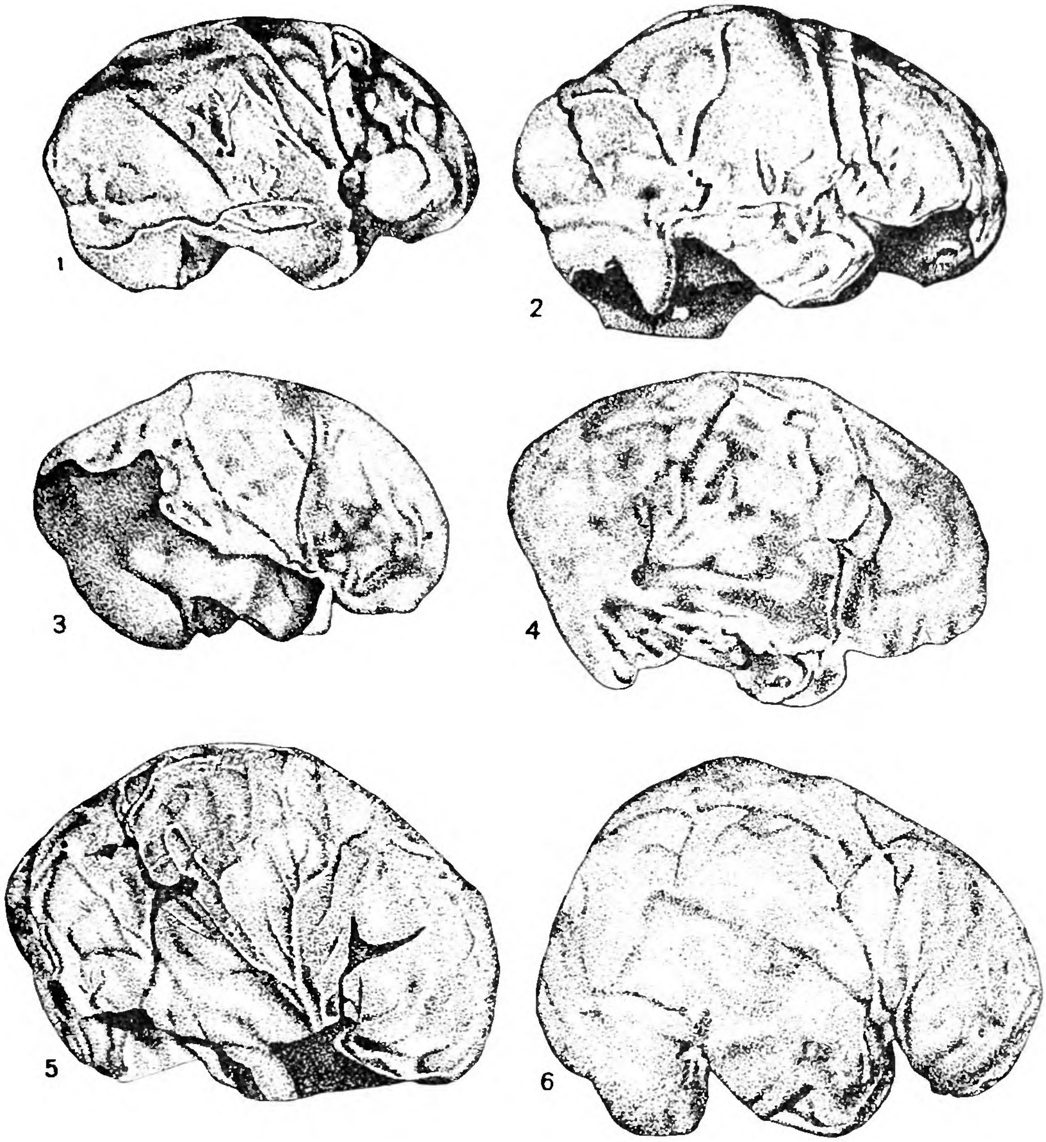


Fig. 146. Cranial casts:

1—Pithecanthropus; *2*—Sinanthropus; *3*—Neanderthaler from Broken Hill and *4*—from La Chapelle-aux-Saints; *5*—fossil man from Předmost; *6*—modern man. $^1/_5$-$^1/_4$ natural size. After F. Tilney, 1928 (*1, 3, 4, 5, 6*) and E. Dubois, 1933 (*2*).

animal. Our Miocene ancestors, the Dryopitheci, had a brain capacity of something like 400—500 c.c., that of the Pithecanthropus was almost twice the size but retained many primitive features, while that of modern man has increased to almost three times the size, and both the shape of the brain and the intricacy of its structure have changed very considerably.

Throughout the Quaternary Period there was a progressive evolution of the absolute dimensions, shape and structure of the hominid brain which went on parallel to a reduction of some of its regions. Definite

information of the changes in the shape and structure of the hominid brain have been obtained by a study of cranial casts made from fossil skulls.

On the inner walls of the skulls of fossil man there are clearly defined traces of the blood vessels that once spread over the surface of the brain, but the convolutions, or gyri, are weakly impressed on the bone. It is not always possible even to distinguish the divisions of the brain with any degree of accuracy. The same difficulties are experienced in studying the cranial casts of modern man. All this makes it difficult, at times impossible, to study such tiny but important regions of the brain as the motor, speech and lower parietal regions that are so important to evolution.

Man's brain is enclosed in envelopes (meninges) that overlay the walls of the cranium more intimately in the child than in the adult, so that the surface of the child's brain is better imprinted on the bone. Tilly Edinger (1929) showed that a cast taken from the cranial cavity of man, the apes, elephant, whale or other animal with a big brain covered with convolutions produces an almost smooth surface. Edinger says that if anybody wants to study a brain from a cranial cast, as a palaeoneurologist has to, he is just groping in the dark.

In this respect Edinger agrees with J. Symington (1915) who considers that:

1) the cranial cast taken from a human skull does not allow the investigator to judge the simplicity or intricacy of the relief of the brain;

2) the casts taken from Neanderthal skulls from La Chapelle-aux-Saints do not permit even of an approximate judgement concerning the relative development of the sensory and associative zones of the cortex;

3) the various conclusions drawn by Boule, Anthony, Elliot Smith and others in respect of the primitive and simian features of the brains of some prehistoric men that resulted from a study of cranial casts are extremely speculative and fallacious.

Nevertheless, these casts, as Edinger agrees, do allow us to draw certain conclusions regarding the shape and the chief features of the brain, such, for example, as the degree of development of the frontal and occipital regions. E. Dubois (1899), in his description of the cranial cast of the Pithecanthropus, stresses the point that there are important if not direct indications on the cast of the typical peculiarities of the primitive shape of the human brain. The Pithecanthropus brain, judging by the cast, had very narrow frontal lobes with highly developed inferior frontal convolutions. Dubois regards this as a possible indication of speech development.

According to Dubois' description the flattening of the Pithecanthropus brain in the parietal region is very typical. It is similar to other hominid brains in one respect—the widest part is at three-fifths of the distance from the margin of the frontal region. In general, says Dubois, the Pithecanthropus brain is rather like an enlarged copy of the anthropoid

brain. There are some peculiarities in which it approximates the brain of the gibbon: the position of the superior precentral convolution and other features, says Dubois, are evidence of this.

Cranial casts from the following skulls are usually employed to determine the Neanderthal type: Neanderthal, La Chapelle-aux-Saints, Gibraltar, La Quina. Edinger gives the following characteristic of the Neanderthal brain (with reservations): the structural type is that of the human brain, but with clearly expressed simian features. It is long and low, narrower in front and wider at the back; the elevation in the parietal region is lower than that of modern man, but higher than that of the apes. The smaller number of gyri and their distribution to some extent resemble those of the ape brain. This is borne out by the angle of deviation of the medulla oblongata and the narrowing, beak-shaped fore part of the frontal lobe (rostrum), and the more developed occipital lobes that contain the visual regions. The vermiform part of the cerebellum is relatively more developed than in modern man and is a more primitive feature.

Greater reliance, says Edinger, is to be placed on the basic dimensions of the fossil hominid brains (table 5).

Table 5 also shows that some of the Neanderthalers had relatively big heads and a big brain.

Table 5

DIMENSIONS OF THE SKULL AND CRANIAL CAST OF HOMINIDS (AFTER TILLY EDINGER, 1929)

Hominids	Length (cm.)	Width (cm.)
Skull		
Modern Man (Bavarians: extent of variation given)	14.3-22.5	10.1-17.3
La Chapelle-aux-Saints	20.8	15.6
La Quina	20.3	13.8
Neanderthal	19.9	14.7
Cranial Cast		
La Chapelle-aux-Saints	18.5	14.5
La Quina	17.75	13.1
Neanderthal	17.5	13.8

It would be possible (although not always) to obtain quite accurate figures to characterize the cranial capacity of other hominids. Of all the primitive and early men-in-the-making the Neanderthaler from La Chapelle-aux-Saints apparently had the greatest cranial capacity (1,600 c.c.) and Pithecanthropus II the smallest (750 c.c.). The extent of the variations in cranial capacity was comparatively small among Neanderthalers—500 c.c. as compared with 900 c.c. in modern man. It must also

not be forgotten that the minimum and maximum, the extent of the variation, depends on the number of individuals studied. The length of the cranial cast taken from the skull of a modern man is about 166 mm. and the width about 134 mm. (V. V. Bunak, 1953).

Developed asymmetry is typical of the skulls of fossil hominids. Usually the left cerebral hemisphere is more strongly developed which may indicate the preferential use of the right hand. Right- and left-handedness is a characteristic feature of man that distinguishes him from the mammals. Considerable asymmetry of the upper extremities could only have appeared among our ancestors after the development of erect locomotion and the inception of labour activities.

Some asymmetry in the size of the hemispheres was also noted among the Pithecanthropi. According to Elliot Smith (1925) the Pithecanthropus must have been left-handed. Frederick Tilney (1928), on the contrary, points to the fact that the left frontal lobe is the more highly developed in the Pithecanthropus brain and assumes that it indicates right-handedness. In general, the greater development of the left cerebral hemisphere can be detected from the skull, there being a more noticeable depression on the inner surface of the left occipital bone. Some asymmetry is also noticeable in the cranial cast of the Sinanthropus.

The brain of the Neanderthaler is clearly asymmetric in the same way as that of modern man. In the cranial cast taken from the La Chapelle skull the left hemisphere is 7 mm. shorter, 7 mm. wider and is higher than the right hemisphere and its parieto-temporal region protrudes to a greater extent. To this must be added the fact that the dimensions of the right clavicle are greater than those of the left.

On the cranial cast of the Gibraltar skull the occipital lobe of the left hemisphere protrudes to a noticeably greater extent than the right. On the La Quina cast the left hemisphere is longer, but the right is better developed. Lastly, the right hemisphere of the Neanderthal cast is bigger than the left.

From these descriptions it can be seen that right-handed individuals were met with among primitive and early men; they seem to be as frequent, if not more frequent, than left-handed individuals. The shape and method of making stone tools as well as the cliff drawings of ancient man also provide evidence of the preferential use of the right or left hand. According to R. Kobler (1932) men were at first left-handed; later, in connection with the use of more intricate types of weapons (for example, in combination with such weapons of defence as the shield) the right hand came to be used preferentially. Kobler refers to the fact that the majority of the ancient stone tools show traces of their having been made with the left hand. Edinger, however, reports that two-thirds of the flint tools made by primitive man in the Upper Palaeolithic were the work of right-handed people and that the same applies to paintings in the caves. Cranial casts of fossil men of the modern type and of their descendants are similar in all important features.

It seems, therefore, that one can agree with D. J. Cunningham (1902) who wrote before the cranial casts of fossil men were known, that right-handedness was a specific feature of man at a very early stage of his development, probably even before his ability to make use of articulate speech. He noted that the left cerebral hemispheres of the majority of modern people are more highly developed than the right.

And so, in the course of the long path of development from monkey to man, in the course of the last few million years, the brain of our ancestors, the Miocene and then the Pliocene anthropoids, grew larger and changed its shape, while in the Pleistocene there was a specially intensive development among the fossil hominids that led to the high level of development we find in modern man.

The evolution of the human brain becomes more comprehensible through the application of Darwin's theory of the development of the organic world and Engels' theory of the role played by labour in the process of man's becoming. The brain had reached a high level of development in the immediate precursors of the hominids, i.e., the Australopitheci, but it received its greatest developmental stimulus with the inception of labour activity among the Pithecanthropi.

The passage from ape to man would have been inconceivable if man's mmediate ancestor had not had a highly-developed brain. This was greatly facilitated by the sudden change that occurred in the behaviour of our ancestors when new types of vital activity appeared, i.e., new methods of acquiring food and of defence from enemies, special methods of performing vitally essential actions with the aid of artificial organs in the shape of man-made tools.

Darwin gave a prominent place to the high mental development of man's ancestors. In his opinion this must have been of primary importance even in very distant times since it enabled him to invent and use articulate speech, manufacture weapons, tools, traps, etc. As a result of this man, with the aid of his social habits, has held a dominant position among all living beings from very ancient times.

Darwin then goes to say: "A great stride in the development of the intellect will have followed, as soon as the half art and half instinct of language came into use; for the continued use of a language will have reacted on the brain and produced an inherent effect; and this again will have reacted on the improvement of language. As Mr. Chauncey Wright has well remarked, the largeness of the brain in man, relatively to his body, compared with the lower animals, may be attributed in chief part to the early use of some simple form of language—that wonderful engine which excites trains of thought which would never arise from the mere impression of the senses, or if they did arise could not be followed out."*

---

* Charles Darwin, *The Descent of Man*, New York, MCMI, p. 785.

The inception and development of articulate speech, probably acquired by man at a very early stage, was of exceptional importance for the evolution of the human brain. In Engels' opinion it had its inception at the time of the transition from ape to man, that is, among men-in-the-making. In his characterization of the historical stages of culture, Engels says the following about the first, the lower stage of savagery: "Infancy of the human race. Man still lived in his original habitat, tropical or subtropical forests, dwelling, at least partially, in trees; this alone explains his continued survival in face of the large beasts of prey. Fruits, nuts and roots served him as food; the formation of articulate speech was the main achievement of this period. None of the peoples that became known during the historical period were any longer in this primeval state. Although this period may have lasted for many thousands of years, we have no direct evidence of its existence; but once we admit the descent of man from the animal kingdom, the acceptance of this transitional stage is inevitable.*

Some scholars date the inception of speech to a very distant epoch, as far back as the Lower or Middle Paleolithic. It is possible that the Sinanthropus already possessed some rudimentary forms of speech. The first stage of real speech development must have been at the time of the Neanderthalers.

Black considers that the Sinanthropus was capable of articulate speech. It may be assumed that the Java Pithecanthropi were not speaking people; like most animals they possessed a number of inarticulate sounds that indicated some inner state and which also acted as signals connected with labour processes and which were more varied than those used by the chimpanzee. It is probable that the primitive men also used non-affective, comparatively soft vocal sounds, the "vital noises" that, according to V. V. Bunak (1951), had a special significance for the development of speech.

The American scientists, Robert Yerkes and Blanche Learned (1925) made a special study of the sounds emitted by chimpanzees. They came to the conclusion that the chimpanzees make use of about thirty sounds, each of which has a special meaning as a signal that indicates some inner state or attitude towards environmental phenomena. It is also possible that there are not so many of these sounds, perhaps only twenty or twenty-five.

Little is known of the sounds emitted by the gorilla. Usually the roar of the male attacking an enemy is described. One scientist was able to observe a male mountain gorilla on a tree trunk with two females; he heard them exchange soft peaceful sounds.

The orangutan uses very few sounds: they are silent animals and emit grunts, roars and yelps only under special stress to express such emotions

---

* Frederick Engels, *The Origin of the Family, Private Property and the State*, see Marx, Engels, *Selected Works*, Vol. II, Moscow 1958, pp. 185-186.

as fear, anger or pain. The loud noises produced by gibbons can be heard for many kilometres.

All the efforts made by Robert Yerkes to teach his chimpanzees to speak ended in failure, although he used various teaching methods. Yerkes also proposed to use methods with his chimpanzees similar to those employed by pedagogues to teach deaf and dumb children to speak. If such methods could have any success at all, it would only be through their application to baby chimpanzees since the ontogenic development of the chimpanzee brain is completed earlier than in man.

It must be remembered that the chief reason for the difficulty in teaching apes even a few words is the rudimentary state of their speech organs. Another thing that must be borne in mind is the considerable difference in the structure of the vocal organs of the apes and man (see article by Bunak mentioned above, 1951).

Ludwig Edinger (1911), noting the high development of the chimpanzee cerebral cortex, admits the possibility of a patient trainer teaching a few words to an ape, but it would remain at an immeasurable distance from man, since the basis for clear understanding, the relevant regions of the brain, are not developed.

Many scientists believe that an anatomical requirement for the development of speech in man is the chin ridge, a feature found only in men of the modern type. The Neanderthalers, as a rule, did not have it, nor did the ape-men or any of the modern or fossil apes (with the exception of the webbed gibbon, the Siamang).

The inception of speech, however, should not be connected with the presence of a chin ridge, since the pronunciation of articulate sounds requires, primarily, the precise correlated work of the whole speech apparatus, including the sensory and mnemonic zones of the brain that are situated in the phylogenically new regions of the parietal and temporal lobes.

According to Louis Bolk, man's chin developed mainly on account of the reduction of the limbus alveolaris, that part of the mandible that carries the teeth. The lower part, the body of the jaw, was subjected to a lesser process of reduction, thus producing a chin ridge.

The protruding lower part of the elephant's mandible is something of an analogy in another mammal; the elephant's dental system underwent a still greater reduction so that it now consists entirely of four molars and two upper incisors, the tusks, that is, six teeth.

Speech functions could have had only a secondary effect on the basic process of chin formation (M. A. Gremyatsky, 1922). More significant in the development of man's speech abilities were: the transformation of the mandible which changed its shape from the elongated to the horseshoe form, the increased size of the oral cavity in which the tongue moves and the freer movement of the lower jaw in new directions due to the reduction of the canine teeth.

Most important in the development of articulate speech are the anatomical and physiological peculiarities of the frontal divisions of the cerebral cortex (parallel to the development of the parietal and temporal regions). Attempts have been made to establish the degree of development shown by this most important part of the brain on the cranial casts of fossil skulls. It is unfortunately, difficult to draw any conclusion concerning the use of articulate speech from the cranial cast, even when it is compared with those of modern man (Edinger, 1929). It is, furthermore, exceedingly difficult even if the brain itself is studied. The cranial cast only shows the shape of the brain in its mantles, or meninges, that form such a complete covering that they hide the convolutions and sulci of the brain and show a picture of only the biggest blood vessels. A new attempt to study the cranial casts of fossil hominids has been made on a large amount of material in the Brain Laboratory of the Moscow Institute of Anthropology (V. I. Kochetkova).

Articulate speech is not a congenital factor. This has been proved, in particular, by the rare cases in which children have grown up in complete isolation, or among animals, far from human society; as a rule, they have not been able to speak when found.

Of all the ties and mutual relations of an individual and group character that existed among the primitive hominids of greatest importance for the inception of speech were those that developed through labour. During the hunting of animals by the entire horde and during the subsequent division of the meat among the members of the community, during the joint fabrication of implements, during all their activities throughout the working day, a day that was taken up entirely by the struggle for existence, the primitive people experienced a need for sound communication that would regulate and correlate their activities. In this way various sounds and, auxiliary to them, gestures and grimaces, became a vital necessity that showed in a readily comprehensible manner the need for certain acts or actions that had to be agreed upon between members of the horde. The sounds of the voice were of special importance in the dark. Then, again, when our ancestors gathered around the fire in their caves there were further opportunities to develop speech habits. The use of fire and the invention of methods of obtaining it must necessarily have greatly stimulated the development of articulate speech as early as Neanderthal times.

Engels evolved the Marxist explanation of how articulate speech developed. He came to the conclusion that speech as a means of communication between people began as vocal sounds accompanied or preceding labour processes and other joint actions undertaken by primitive man. "The mastery over nature, which begins with the development of the hand, with labour," wrote Engels, "widened man's horizon at every new advance. He was continually discovering new, hitherto unknown, properties of natural objects. On the other hand, the development of labour necessarily helped to bring the members of society closer together,

by multiplying cases of mutual support, joint activity, and by making clear the advantage of this joint activity to each individual. In short, men-in-the-making arrived at the point where *they had something to say* to one another. The need led to the creation of its organ; by modulation the undeveloped larynx of the ape was slowly but surely transformed for ever more developed modulation, and the organs of the mouth gradually learned to pronounce one articulate letter after another."*

The high development of the brain coupled with erect locomotion and the use of the hand were important prerequisites to the emergence of speech, but no less important was the effect of speech on the brain. With regard to this, Engels wrote:

"First labour, after it, and then with it, articulate speech—these were the two most essential stimuli under the influence of which the brain of the ape gradually changed into that of man."**

Speech was a phenomenon of great advantage, it was useful to society and, therefore, its development inevitably continued.

Engels cites examples from animal life in support of his theory of the development of speech through labour. The human voice may have meaning for wild animals only as a danger signal, but the sounds of human speech become to a certain extent comprehensible to domestic animals, to dogs, for example, no matter in what language man may speak, but always, of course, within the conceptual limits of the animal brain.

Words pronounced by man become signals for definite actions on the part of domestic animals, actions that either the man or the animals themselves must perform. Animals capable of the rapid and stable development of conditioned reflexes (i.e., animals that can be trained) prove, when tamed or domesticated, better able to understand when obedience to the signal meets with approval and disobedience meets with punishment.

The sounds of articulate speech that at first most likely served as signals for actions gradually came to indicate objects and phenomena; the number of sound signals increased and greater importance was attached to their force, tone, overtones, intonation and sequence. And as sound language or speech developed, the apparatus producing the sounds also underwent certain changes. The sound analysers in man were perfected, although they are not always so delicately attuned to the reception of the finer differences of the frequency and timbre of speech sounds as those of some other mammals. But man is immeasurably superior in his comprehension of their inner content, especially when he is dealing with some combination of sounds; in this respect his sound analyser is highly specialized and enables him to distinguish a far greater number of sounds and their meanings than any animal can. The periph-

---

* F. Engels, *The Dialectics of Nature*, Moscow 1954, p. 231.

** *Ibid.*, p. 233.

eral region of man's sound analyser, like that of some apes, underwent a process of reduction as can be seen in the almost complete immotility and the rudimentary nature of the muscles of the human ear.

The cortical region of the human sound analyser, according to S. M. Blinkov's researches (1955), differs qualitatively and structurally from the relevant region even in the anthropoids; this is also true of the entire temporal lobe. It is not only the temporal, frontal and parietal lobes of the cerebral cortex that are involved in speech functions but the cortex as a whole.

Man alone is able to think in words: the second system of signals, to use Pavlov's terminology, is an important basis for the development of consciousness. The second system of signals is intimately bound up with the first system that covers conditioned reflexes of the usual type and unites the conscious, specifically human conditioned reflex to the spoken word that indicates actions, objects, and the relationships between them, concepts, etc. Pavlov's thesis on the second system of signals is one of the greatest achievements of Soviet science. It enables us to extend Engels' concept of the origin of speech in the course of work processes. This is a problem on which many Russian thinkers have focussed attention. We find some interesting ideas on the inception of speech in A. M. Gorky's writing:

"We know that the abilities that distinguish man from the animals developed and still continue to develop in the course of labour processes; the ability to use articulate speech also grew on that soil." At first, he says, verbal forms and measuring words (heavy, far) developed and then names for the implements of labour. In Gorky's opinion there were no meaningless words in rudimentary speech. Gorky speaks of the close organic connection between human speech, the human mind and man's labour activities: "Human reason flamed up during work on the reorganization of crudely organized matter and is itself nothing more than delicately organized energy, energy that is constantly becoming still more delicately organized and which has been extracted from that matter in the course of work on it and with it, by the investigation and assimilation of its forces and properties."

It seems likely that articulate speech promoted the progressive development of man as early as the Neanderthal stage: the intensive growth of speech at that period probably facilitated the conversion of early man into the higher type, the Cro-Magnon man. The later Neanderthalers, with their ability to make fire, with the inception of the custom of burying their dead in caves and grottos that had served as dwellings, with their methods of working bone, were at a higher stage of development than their predecessors, the early Neanderthalers.

Articulate speech developed and grew more complicated among fossil men of the modern type, i.e., the new, "complete" or reasoning people, who went through the subsequent stages of the history of material

culture, the stages of social and economic development, at a constantly increasing rate.

As can be seen from the above brief outline modern man is the result of a long process of evolution which, in the first and most lengthy division of man's phylogenic history, was a component part of the common evolution of the animal kingdom and was subject to its biological laws.

But the emergence of the first people with their labour, social habits and speech was a leap forward, a break in the chain of evolution. By means of an abrupt change, a sudden, decisive turn in the course of evolution, there began a new stage in the development of living matter in the form of emergent man. This was the beginning of a completely new process of the formation of man. Men-in-the-making were not animals, as B. F. Porshnev assumes (1955), when he regards only representatives of the species *Homo sapiens* as people.

The labour of the most primitive and early man who made his own tools differs qualitatively and in principle from the labour of beavers, ants, bees or birds building their nests. Only natural, biological factors operate in the evolution of animals.

The conversion of the ape into man took place under the influence of a whole group of social and biological factors: this formative process, qualitatively different from the evolution of the animal kingdom, can only be understood from the standpoint of Engels' dialectical, materialist concept of the decisive role of labour.

The dialectical materialist concept of the making of man, his brain, speech and thought serves as a sound basis in Soviet anthropology for profound research into anthropogenesis, for the struggle against every kind of idealist hypothesis in this branch of the science of man and also in the study of races and the exposure of racism on the basis of anthropological data.

CHAPTER THREE

MODERN MAN (NEANTHROPUS)

1. UPPER PALAEOLITHIC MAN

The beings that created the Late, or Upper Palaeolithic cultures had a physical structure different from that of the Neanderthal men. No Neanderthal fossil bones have been found together with Upper Palaeolithic stone implements. The skulls of the Cro-Magnon and other fossil men of the modern type had a straight forehead, supra-orbital arches (in place of the ridge) and a chin or mental protuberance, all of which are features possessed by the skulls of men with a high level of physical development. A much higher cultural level also distinguishes the Cro-Magnon from the Neanderthal men. With the aid of new techniques their tools were made with much greater skill, some of them were of bone or horn (fig. 147). They also fitted handles to some tools which marked a big and important step forward.

The Upper Palaeolithic is divided into three epochs—Aurignacian, Solutrian and Magdalenian. They are equated with the second half of the period of maximum glaciation, the end of the glacial epoch and to a considerable extent with the postglacial epoch, towards the end of which comes the next great cultural division, the New Stone Age, or Neolithic.

The Upper Palaeolithic began when it was still extremely cold, in the second half of the period of maximum glaciation. The fauna included the reindeer, mammoth, woolly rhinoceros and the wild horse (fig. 148). The number of squatting places in caves, grottos and under overhanging cliffs was much greater in the Aurignac than in the Mousterian phase. Later, as it grew warmer, people made their encampments in the open (fig. 149). It was in this warmer epoch that they began their intensive hunting of the wild horse (fig. 150): the extent of horse hunting may be judged from the fact that the bone remains of about 100,000 horses were found at a squatting place at Solutré (France). The Cro-Magnon folk also hunted the aurochs (fig. 151).

Fig. 148. Mammoth hunt.
Fresco by V. Zvyagintsev. Museum of Anthropology, Moscow State University.

Camping grounds in the open predominate in the Solutré Epoch. Laurel-leaf spearheads and bone articles are typical of the implements of that epoch.

In the Magdalenian Epoch the cold returned to some extent—this epoch corresponds to the Würm glacial epoch. The Cro-Magnon folk were again driven more frequently to their caves. They had to dispute the ownership of these caves with the wild animals that were their rivals in the quest for a dwelling. Reindeer hunting is typical of the Magdalenian Epoch when the art and technique of tool-making underwent a radical change. Typical of the new epoch were the tiny stone tools (microliths) and many artifacts of bone and horn.

The most important find of Cro-Magnon fossil bones was made in the Cro-Magnon cave on the River Vézère near Les Eyzies, Département Dordogne, France, in 1868. The cave contained five skeletons from which it may be judged that they were a tall race of people up to 180 cm. (6 feet) in height. The cranial capacity of the skull is very great, one of them being 1,590 c.c. The face is very broad, the supra-orbital arches are rather prominent but there is a depression between them (glabella) as in modern skulls: in other words there is no thick supra-orbital ridge or torus that is so strongly expressed in Neanderthal types. Traces of the Cro-Magnon culture were also discovered in the cave—these included bone harpoons in addition to the Upper Palaeolithic stone implements.

In 1909 the skeleton of a modern-type man was found under an overhanging cliff at Combe-Capelle, near Monferran (Dordogne, France). The skeleton lay absolutely untouched in the very lowest Aurignacian cultural stratum. A large number of flint tools and drilled shells were found with it. The bones of the skeleton had been calcified by the lime contained in the water dripping from the roof above it and were excellently preserved. The skeleton is of great antiquity: judging by the implements found with it the Combe-Capelle man lived in the Early Aurignacian Epoch. His height was only a little over 160 cm. The long axis of the skull was very long (index 65.7). The German anthropologist, Hermann Klaatsch, gave it the name of Aurignacian man. Some scholars are of the opinion that the Aurignacian man could well be called a Cro-Magnon man like other representatives of the modern type such as those taken from the Cavillon grotto in France (fig. 152).

In 1936, on the territory of the U.S.S.R. the remains of Cro-Magnon types were found in the Mursak-Koba grotto on the left bank of the River Chornaya near the village of Gorgun (Balaklava District, Crimea). The find consisted of the skeletons of a man and a woman buried together (S. N. Bibikov, 1940; Y. V. Zhirov, 1940). The male skeleton (partially destroyed) had a length of 180 cm.; the female skeleton was well preserved and had a length of 160 cm.; the skeletons belong to the Mesolithic Epoch.

S. N. Bibikov and S. A. Trusova, who discovered them, had previously discovered an undamaged male skeleton of the same epoch under the

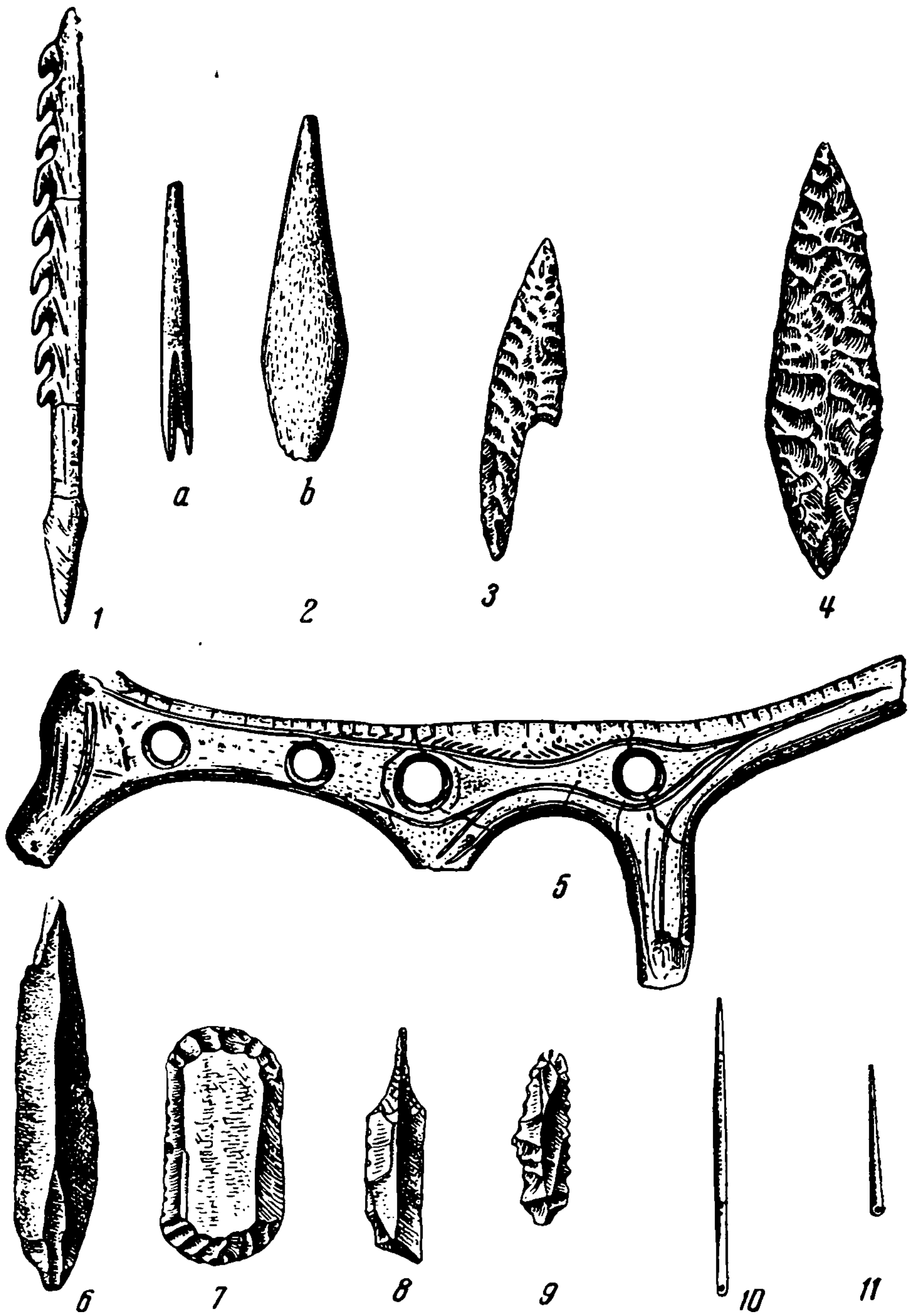


Fig. 147. Stone and bone implements from Upper Palaeolithic:

1—horn harpoon; *2*—bone spearheads; *3*, *4*—flint spearheads; *5*—tool for straightening spearhafts; *6*—cutter (knife); *7*—scraper; *8*—drill; *9*—needle sharpener; *10*, *11*—bone needles. (Reduced.)

Fig. 149. Cro-Magnon folk making tools.
After E. Forestier, 1931.

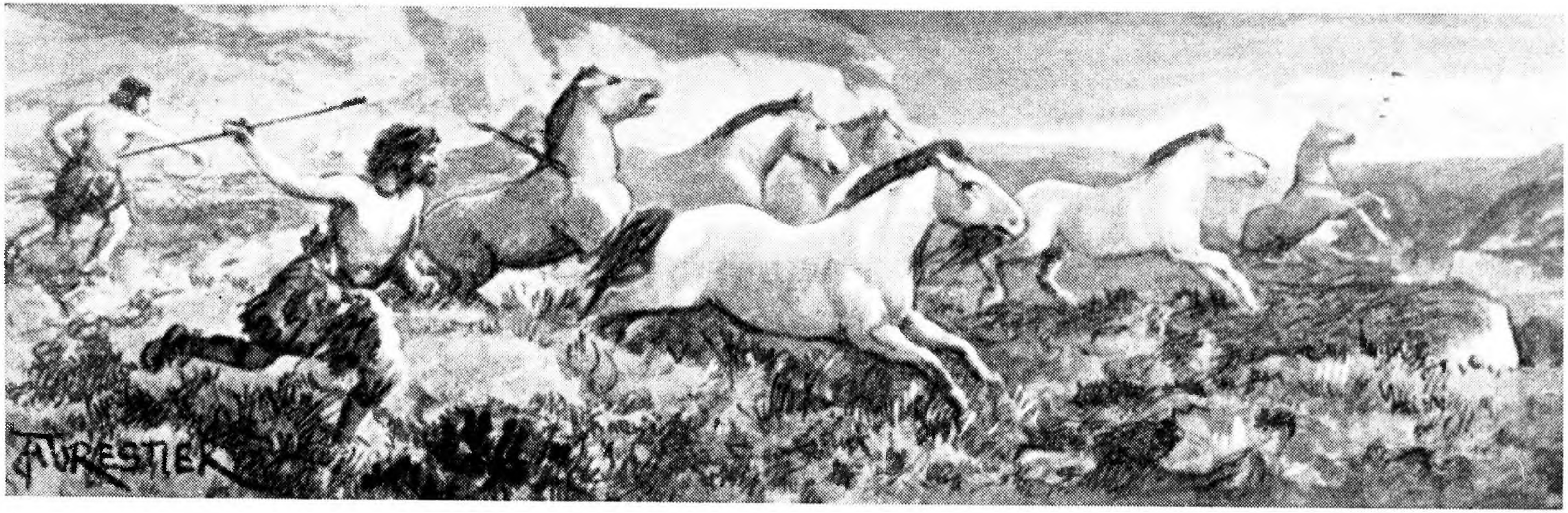


Fig. 150. Magdalenian hunters chasing wild horses.
Archives of Museum of Anthropology, Moscow State University.

Fig. 151. Early men of the Magdalenian epoch hunt aurochs by driving the herd a to cliff edge. Vicinity of Amvrosiyevka, 2 km. from Krynka (tributary of the Mius), Donets Basin.
Reconstructed by I. Pidoplichko, 1953.

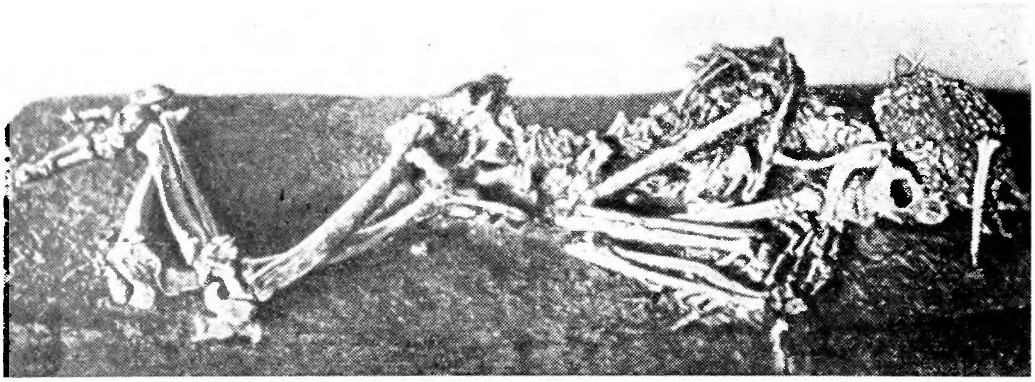


Fig. 152. Cro-Magnon burial in Cavillon grotto, Menton, France.
After J. McCardy, 1924.

Fatima-Koba cliff in a gully leading into the River Chornaya. The length of this skeleton was 168 cm. The prominent facial region and some other features indicated a Negroid admixture (M. M. Gerasimov, 1955).

Finds of this type give rise to the idea of the common origin of the black and white races. One of the latest discoveries made by Soviet scientists tends to support this view. When archaeologist A. N. Rogachov was excavating in the village of Kostenki on the banks of the Don some 45 kilometres south of Voronezh, he discovered a burial dating back to the beginning of the Upper Palaeolithic at the squatting place Kostenki XIV, a place known as Markina Gora.

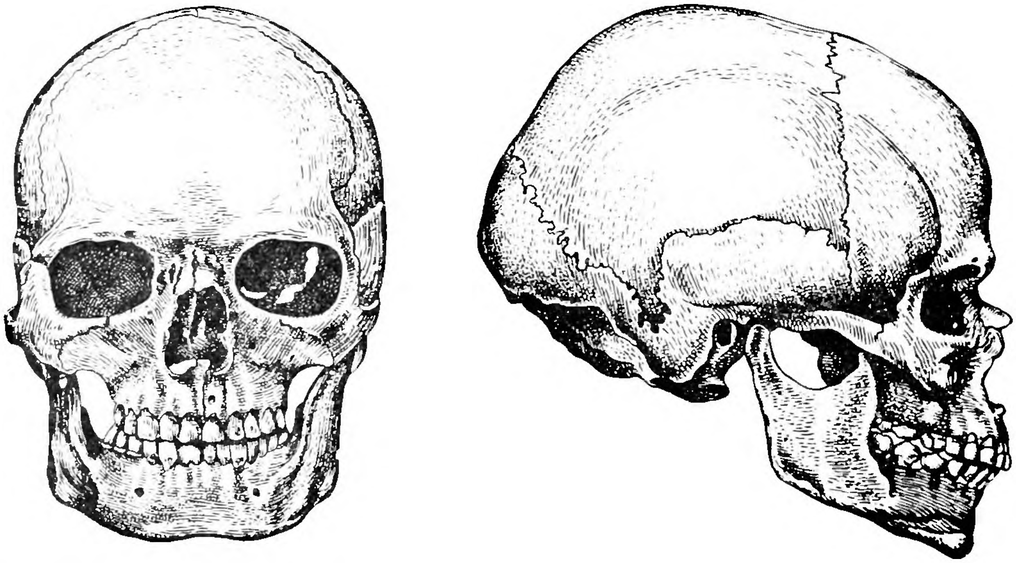


Fig. 153. Skull Kostenki XIV from Upper Palaeolithic burial, camping ground Markina Gora, near village of Kostenki, 45 km. south of Voronezh. Restored by M. Gerasimov.
$^{1}/_{4}$ natural size. After G. Debets, 1955.

Fig. 154. Cro-Magnon skeletons: youth (right) and woman, both with some Negroid features. From La Grotte des Enfants, Menton, France.
After R. Verneau, 1906.

The complete skeleton of a young man about 25 years of age was found lying on its side. The study of the skull (fig. 153) drew the attention of anthropologist G. F. Debets to the very wide nasal orifice and the prognathous jaws. Since these are features typical of Negroid skulls, Debets considered that the skeleton was evidence of the penetration of southern types to the north, possibly from the area of Asia Minor. On the other hand, this skull with its mixture of Negroid and Europeoid features resembles the skull from Grimaldi and supports the idea of the phylogenic relation of the black and white races and, consequently, the thesis of the unity of mankind that emerges from the materialist conception of anthropogenesis.

A. N. Rogachov and P. I. Boriskovsky also discovered other skeletons of fossil man at Kostenki (G. F. Debets, 1955; V. P. Yakimov, 1957).

In addition to the skeletons from Cro-Magnon and Combe-Capelle, other types of man closely related to them have been discovered. The Grimaldi folk, for example, lived in Europe at the very beginning of the Upper Palaeolithic; remains of these people were found in La Grotte des Enfants near Menton on the borders of France and Italy. The skeletons found there belonged to a youth of 16-17 years and a woman 30-40 years of age; they were people of small stature (157 and 155 cm.) and possessed certain Negroid features (fig. 154).

The Grimaldi type is a possible indication that Negroid elements penetrated from Africa into Europe. In those times people of different races could migrate from Africa to Europe and back. So far the Grimaldi skeletons are the only find of their kind and the penetration of Negroid elements from Africa into Europe was probably of a limited nature. The development of the Negroid race in that epoch is shown by the male skeleton found at Asselar, a post in the Sahara Desert 400 km. to the north-east of Timbuktu (Timbuctoo) and 20 km. to the south-east of el-Mabrouk (fig. 155).

In the Solutrean Epoch in Europe there lived the Brünn race. The cranial vault of one representative of this race was found in 1871 near the town of Brüx and the skeleton of another in 1891 near Brünn (Brno) both in Czechoslovakia. This race of people had extremely long skulls: one of them has an index of 68.2 with strongly developed supra-orbital arches. This, added to other features, approximates the Brünn type to the Neanderthal. But the cranial vault is higher than that of the Neanderthal type and there is a chin which, in general, makes the Brünn skull closer to that of the modern type of man, like the skulls of the Grimaldi folk or the Aurignacian skull from Combe-Capelle.

Some anthropologists regard the remains of fourteen skeletons found at Předmost, Czechoslovakia, beginning with 1880 as belonging to the Brünn race. According to data cited by J. Matiegka (1935), the skulls of this series have a big cranial capacity: skull III (male)—1,608 c.c.; skull IV (female)—1,518 c.c.; skull IX (male youth)—1,555 c.c.; skull X (young female)—1,452 c.c. Characteristic features are—strongly devel-

Fig. 155. Skull from Asselar, Sahara, North Africa.
About $^1/_4$ natural size. After H. Weinert, 1939.

oped supra-orbital arches and a sloping forehead (fig. 156). Matiegka was of the opinion that the skulls, from a morphological viewpoint, come between the Early Quaternary types of man and modern man.

Neanderthal features are found in a number of other types besides the Cro-Magnon types from Brünn, although they are not always so pronounced. The Oberkassel skeletons discovered near Bonn (Germany) in 1914 possess some of these features. The skeletons are those of a woman of about 20 and a man of 40-50 years of age. They are Cro-Magnon type with heavy supra-orbital arches and the face is very wide between the cheek-bones (figs. 157-158).

The Cro-Magnon skulls found at Podbaba, Tilbury, and other places all retain certain Neanderthal features.

A special place is occupied by the cranial vaults with features of an intermediate type found on the territory of the U.S.S.R.—the Podkumok, Skhodnya, Khvalynsk, Severskaya and Kebelai types.

The first of these was found during excavation work on the River Podkumok, near Pyatigorsk, in 1918. It was described by M. A. Gremyatsky in 1922. His study of the skull showed that the pronounced supra-orbital bony processes, the posteriorly lower supra-orbital ridge, the

sloping forehead and other features were of a Neanderthaloid character. Some scholars regard the Podkumok skull, on account of the sum total of its morphological features, as belonging to a man of the modern type: the same is apparently true of the Skhodnya and Khvalynsk cranial vaults (O. N. Bader, 1936, 1940; M. A. Gremyatsky, 1948).

In 1936, on the banks of the River Skhodnya, near Moscow, a cranial vault was discovered that apparently belonged to a man of the modern type but which had certain Neanderthal features. O. N. Bader (1936) described the find *in situ* and made a brief description of it. He speaks of some points of similarity with the Podkumok skull and regards the Skhodnya skull as being one of the transitional forms between the Neanderthal and modern types.

The third cranial vault was found as long ago as 1927 near the town of Khvalynsk on the island of Khoroshensky (O. N. Bader, 1940), but to the present day has not been described in detail. The discovery made by A. V. Bodyansky of fragments of frontal bones near Dniepropetrovsk (N. N. Karlov, 1949) has been described by T. S. Konduktorova (1952).*

Fig. 156. Skull of modern type fossil man from Předmost, Czechoslovakia. Skull III (male).
About $^1/_3$ natural size. After J. Matiegka, 1935.

* All these specimens are in the Moscow Institute of Anthropology.

Fig. 157. Male skull from Oberkassel, Western Germany.
About $^1/_3$ natural size. After H. Osborn, 1924 (*1*) and after E. Werth, 1929 (*2*).

W. Gudelis and S. Povilonis (1952) have reported the find, in Lithuania, of an incomplete cranial vault with transitional features. In 1950, near the village of Kebeliai, Klaipeda Region, a human frontal bone with small pieces of the temporal bones attached was taken from a gravel quarry. The supra-orbital arches are strongly expressed, the forehead is sloping and narrow; these and some other features are regarded by the above-mentioned authors as being analogous to features of the Skhodnya vault. While noting the Neanderthal features they nevertheless regard this individual (male, 30-35 years) as belonging to a modern type of man. The cranial vault is not of very great antiquity: according to the geological chronology of Lithuania the cranial vault belongs to the littoral period (3,000-4,000 years B.C.) which corresponds to the Mesolithic or the beginning of the Neolithic. Another interesting find was that of a child's skull at Staroselye, Crimea (*Sovietskaya Etnografia*, 1954, No. 1).

Skulls with these transitional features are occasionally found among collections of modern skulls. This is evidence of the descent of Cro-Magnon types and of modern man in general from the Neanderthal type. The Cro-Magnon type has not completely disappeared: in some places it is clearly expressed even today, for example, in the physical features of the people of certain parts of France (G. F. Debets, 1936).

Many scholars have raised various objections to the opinion that the Neanderthal type was the starting-point of modern man. The difference in the structure of the teeth, for example, has been pointed out; this is expressed, in particular, in the big dental cavity of the Neanderthal molars extending almost to the end of the long and short roots. As we have already mentioned, this type of tooth is known as taurodontal to distinguish it from the cynodontal tooth of modern man with its long roots and small cavity (Keith, 1933). The taurodontal form, however, is occasionally found among modern people; in some human groups it occurs in as many as 20-30 per cent of individuals.

The extent to which the Neanderthal type spread all over the Old World shows the great viability of this species of hominid and of its successful adaptation to varied geographical conditions, including the difficulties that were placed in its way by the ice age.

"Just as man learned to consume everything edible," wrote Engels, "he learned also to live in any climate. He spread over the whole of the habitable world, being the only animal that had the power to do so on its own account. The other animals that have become accustomed to all climates—domestic animals and vermin—did not become so independently, but only in the wake of man. And the transition from the uniformly hot climate of the original home of man to colder regions, where the year was divided into summer and winter, created new requirements: shelter and clothing as protection against cold and damp, new spheres

Fig. 158. Fossil man from Oberkassel, Western Germany. Reconstructed by M. Gerasimov.
Moscow Museum of Anthropology.

for labour and hence new forms of activity, which further separated man from the animal."*

Adaptation to the various climatic changes during the Quaternary Period was one of the reasons for man's intensive evolution, the development of production and of the physical organization of man himself. By the beginning of the Upper Palaeolithic the industry and physical type of the Neanderthaler had been transformed into the industry and physical type of the Cro-Magnon man.

Did this process of transformation proceed at the same rate and with the same ease everywhere? Were there races of Neanderthalers that became the separate prototypes of the Europeoid, Mongoloid and Negro-Australoid racial divisions of modern mankind? These are urgent questions that have been raised during the past few decades by anthropologists in the Soviet Union and abroad. F. Weidenreich, for example, propounded a typical polycentrist hypothesis which postulated four centres for the making of modern man: the original homes of the Europeans, Mongolians, Negroes and Australians, four areas in which the chief races took shape. From this is drawn the conclusion that there is no relationship between the races.

Another viewpoint, elaborated in the form of a monocentrist hypothesis, has been propounded by the Soviet anthropologist Y. Y. Roginsky. He showed that the races of today have a complex of skull characteristics (he studied a series of skulls from each race) indicating that in their physical structure they more closely approximate each other than Weidenreich's hypothesis allows for. The documentary data possessed by Soviet anthropology, taken in conjunction with Engels' labour theory of anthropogenesis, are sufficient to refute Weidenreich's not very elucidating constructions (Y. Y. Roginsky, 1949; M. G. Levin, 1946).

How was the transition from the Neanderthal type to modern man effected? What factors made possible the final stage in the long process of transition from ape to man, to the man who perfected himself under the influence of the most powerful factor—labour?

According to Roginsky's theory (1936, 1938) the development of the Neanderthalers into Cro-Magnon types took place in the primitive communities that emerged from the Mousterian hordes; the horde with its semi-animal egoism and still insufficiently curbed savage instincts became a higher social body, the gens or clan (S. P. Tolstov, 1946). The formation of a real community out of the primitive horde is one of the most distinctive culminating features of the making of man. The contradiction between savage instincts inherited from the previous stage in the development of the primitive community and the growth of labour techniques was overcome and was the beginning of more complicated social relations. And those communities that were better adapted to the

* F. Engels, *The Dialectics of Nature*, Moscow 1954, p. 237.

Fig. 159. Drawings of animals made by ancient hunters on walls of Zaraut-Sai Gorge, Surkhan-Darya Region, Uzbekistan.
Fresco by A. Kirillov and A. Roginskaya. Museum of Anthropology, Moscow State University.

new living conditions and had the more progressive social organization proved the most viable.

It is probable that by this time natural selection no longer had such great significance as it had had in the main period of the formation of man, because man, in the narrow sense of the word, was now fully evolved. The hand and the foot had reached a high level of development, the pelvis had turned to an angle of about 60° with the horizontal; the vertebral column had, at last, acquired its human curvature; the neck had acquired its distinctive shape; the head was now poised directly on the spine and was well balanced and the brain had reached a very high level of development in all representatives of the human race. A new being had developed from the more primitive, less specialized form of the Neanderthalers, a being that could with all justice be said to belong to the species *Homo sapiens*, reasoning man. When Linnaeus gave man this name to distinguish him from other living beings he gave it a special significance. He regarded the human intellect as being a particle of the divine spirit. We may retain Linnaeus' term since it is firmly established in science, but we must give it a new meaning; by reason we must understand the purely materialist ability to think, which developed to the greatest extent in modern man some tens of thousands of years ago.

The postglacial epoch has lasted about 15,000 years. The end of the Upper Palaeolithic in Western Europe came about 10,000-12,000 years ago. Since that time there has been a further change in fauna and flora due to the ending of the ice age.

At the end of the Upper Palaeoloithic man was hunting the deer and very often, the mammoth. He had taken to fishing as an occupation which, in turn, led to the invention of a number of special new implements. The groups still lived in caves as the climate continued quite cold.

Parallel to the Cro-Magnon types that had formerly existed, new types appeared, not only dolichocephalic (long-skulled) but also brachycephalic (round-skulled) races. The physical type of Neolithic man very closely resembled that of men living today. Probably the most remarkable difference between the living and fossil representatives of modern man is to be found in the structure of their teeth and jaws. This is no doubt due to the change in diet that had, in the past, undoubtedly been of a much cruder nature. Keith (1933) summarizes these differences as follows: the fossil races of man all had wisdom teeth that showed some reduction in size and development; the crowns of the teeth were badly worn down; diseased teeth were rare. In modern man some of the wisdom teeth, sometimes even all of them, erupt at a very advanced age and in some cases do not appear at all, the grinding surface of the teeth is not greatly effaced and diseased teeth are common.

The culture predominating at the end of the Upper Palaeolithic has been called the Azil-Tardenoise culture from the names of two

encampments discovered in France. The older of them at Azil (in the foothills of the Pyrenees) is distinguished by flat harpoons and pebbles ornamented with coloured symbols. The later culture, Tardenoise (in northern France) is distinguished by microlithic tools of peculiar shapes, resembling trapezia and segments. This culture is also called Mesolithic because it is intermediate between the Palaeolithic and Neolithic; it has, further, been called Epipalaeolithic (M. V. Voyevodsky, 1934, 1950, 1952). The bow was invented and the dog was domesticated in this period.

The real Neolithic, or New Stone Age, is distinguished by the appearance of polished and drilled stone tools, the use of pottery, the building of pile dwellings and the taming and domestication of various animals. First of all man tamed mammals, the oldest of which, as we said above, was the dog, then came the pig, the horse, the cow and the sheep.

All these varied and beneficial cultural achievements could only have made their appearance through the progressive development of human collectives, the primitive communities. The hunting of wild animals continued and they are depicted, although in a more schematic form, on cliffs and the walls of caves (fig. 159).

The cave ceased to be the permanent habitation of man in the Neolithic Period. In addition to pastoral pursuits the tilling of the ground was begun, a prominent part in the latter belonging to the women of the community. The beginning of a new turning-point in man's economy was the discovery of the useful properties of metals. Metallurgy was used with tremendous success by man in the course of his further social development (the Bronze Age, the Iron Age).

2. FALSE HYPOTHESES CONCERNING THE ORIGIN OF MODERN MAN AND THEIR CRITICISM

Many hypotheses concerning the origin of modern man have been proposed, but we shall first of all examine some of those that claim that the modern type of man has existed for all time. Oswald Spengler (1933) declared that we know nothing of man having had any ancestors and that man has always been what he is today. The Neanderthaler is to be seen at any public meeting, he maintains. This assertion is obviously dictated by his hatred for the people and contradicts all the known scientific data on the skeleton of the Neanderthaler and that of modern man; it is a weak attempt to prove that the modern type of man has existed throughout all time. The views of such reactionaries as Spengler must be resolutely refuted.

Equally unacceptable is the hypothesis propounded by Kasimir Stolyhwo (1937) who considers the Neanderthalers to have been one of the human races, a variety of *Homo sapiens*, and that they are the form typical for the Mousterian Epoch. He also believes that the Neanderthal type is still to be found here and there among modern men.

The more ancient hominids, with their strongly expressed supra-orbital ridge, low cranial vault and no chin are, according to Stolyhwo, plus varieties of preneanderthaloids, and those with more regular relief and higher cranial vaults are minus varieties of postneanderthaloids. He supposes the majority of the latter to be hybrids from Neanderthalers and modern men and those with the more massive skeleton to be the real descendants of the Neanderthalers. None of Stolyhwo's conceptions, however, can refute the theses of stadial development and the regular line of descent shown by the physical types of fossil hominids and the absence of Neanderthaloid groups among modern mankind. For Stolyhwo's hypothesis it is necessary to approximate the modern Australians and the Neanderthalers; this, of course, is false since the Australians are obviously Neanthropic in their physical structure, that is, they are people of the modern type with supra-orbital arches and no ridge; they are not, furthermore, the result of crossing modern man and the Neanderthalers.

Another objection to the theory that modern man descended from the Neanderthal type claims that modern man not only existed simultaneously with the later Neanderthalers (this could be accepted in certain cases), but that he existed much earlier, at the same time as the earliest Neanderthalers and even the ape-men. Such great antiquity was attributed to the Eoanthropus or Dawn man, well known in anthropological literature. In 1911 it was announced by Charles Dawson, that at Piltdown, some 70 km. south of London, the lower jaw and parts of the cranial vault of a very ancient man had been found. Later Dawson reported the find of small fragments of a similar skull and a lower canine tooth near the place where the first was found.

The lower jaw with its canine tooth projecting well beyond the other teeth was very simian in its appearance and was in complete disharmony with the skull bones. Despite this, British anthropologists announced that the cranial vault and the mandible belonged to the same skull of a fossil type of man. The English anatomist and anthropologist, Sir Arthur Keith, made various reconstructions from the fragments.

Soviet scientists were always very doubtful of the Piltdown find. Its unauthentic character was exposed in 1954. It was shown that the mandible was that of a modern chimpanzee that had been treated with bichromate of potassium to give it a semblance of antiquity (M. A. Gremyatsky, 1954).

An analysis of the Eoanthropus finds demonstrated the failure of an attempt made by bourgeois scientists to prove that modern man is more ancient than the Neanderthaler, his predecessor.

A fragment of a female skull found at Swanscombe on the River Thames (England) in 1935 has lately been linked up with the Eoanthropus skull. Great age is attributed to this fragment on account of the Acheulian stone implements found with it; its geological antiquity is open to some doubts (G. I. Petrov, 1939).

Judging by the fragment found, the length of the skull must have been 185 mm. and the width 144 mm.; the cranial capacity has been estimated at about 1,350 c.c.; the cranial vault is low.

Y. Y. Roginsky (1947) made a special study of the fragment and demonstrated quite convincingly that the occipital bone of the Swanscombe man shows specific Neanderthaloid features.

The incorrect interpretation of the Oldoway skeleton is an instructive example of an attempt to attribute extreme antiquity to modern man. The skeleton was discovered in 1913 by the German geologist Hans Reck to the west of the Kilimanjaro volcano in East Africa at a place called Oldoway.

The skeleton was well preserved and was found at no very great depth below the surface. The type was very reminiscent of the modern Massai, an African people. The teeth had been sawn down like those of some African tribes. The skeleton was in a crouched position and seemed to have been securely tied before burial (M. F. Nesturkh, 1932). Ancient fossil fauna remains were found in the same stratum. Hans Reck expressed the opinion that the Oldoway man had lived 250,000 years ago.

In the opinion of other scholars the Oldoway skeleton was that of a modern African who had merely been buried in a stratum of earth containing fossil bones of ancient animals.

An expedition equipped in 1932 to check up on the skeleton consisted of Hans Reck and two other scientists; they discovered stone implements of great antiquity and the fossil remains of Tertiary mammals. The extreme antiquity of the skeleton, however, was not confirmed and a study of soil adhering to the bones revealed that it contained a mixture of soil from the surface layers, i.e., layers of lesser geological age. C. F. Cooper and D. M. S. Watson (1932) were of the opinion that this indicated the more recent nature of the burial. Reck's unfounded attempt to attribute antiquity to the remains of a modern man was exposed.

Thus the story of the discovery of an ancient representative of modern man in Africa proved to be false, a legend that had been invented and supported by those scientists who wanted to prove that modern man is more ancient than the Neanderthal type and has existed for almost the entire Quaternary Period. The course of evolution taken by the Upper Tertiary Primates and the Quaternary hominids, as we have seen, contradicts this viewpoint. It was with good reason that many scientists did not believe the legend of the Oldoway man. The legend was completely exposed at the World Congress of Archaeologists held in London in 1932.

A recent discovery of a similar nature was that of a skull found in 1948 in the Fontéchevade cave, Departement Charente (France) by archaeologist G. Henri-Martin, who announced that her find was of greater antiquity than the Neanderthal remains. The fallacious nature

of this assertion was exposed by Y. Y. Roginsky (1950), who made a comparative study of the Fontéchevade skull, Neanderthal skulls, modern skulls and those of the transitional type. His analysis showed that the skull, which the French woman scientist and the American anthropologist Laurence Eisley had declared to belong to a representative of the species *Homo sapiens*, was one of the Neanderthal forms.

A German scientist, the biologist, Otto Kleinschmidt, well known for this idealist theory of "biological circles," also supports the erroneous idea that modern man has existed for all time. According to his hypothesis every species develops as an independent agglomeration of varieties and other tiny subspecies and it is not in any way related with other circles of forms. The question of the ancestors of the particular circle of forms under discussion is of no great interest to Kleinschmidt.

Kleinschmidt needed such postulates to remove the ground from under Darwin's materialist theory of natural selection combined with the formative influence of the environment in the course of the evolution of the organic world. Using such negations as a basis, Kleinschmidt makes a sharp demarcation of the human circle and absolutely refutes man's relationship to the anthropoid apes. He maintains that all the fossil hominid forms, beginning with the Pithecanthropus, belong to the circle of reasoning beings. This links up Kleinschmidt with Spengler and other reactionary scientists.

The pseudo-scientific theory of the existence of the species *Homo sapiens* from the beginning of time is actually a denial of evolution and is closely related to religion. It is a veiled attempt to give a quasi-scientific interpretation of the Biblical myth concerning the miraculous creation of Adam and Eve.

Another group of fallacious hypotheses gives a purely biological explanation to the making of man, which, they allege, is independent of social influences. These are nothing but metaphysical conceptions of man as a biped mammal.

One such group of hypotheses lays special stress on the endocrine system and tendentiously exaggerates the significance of man's lengthy process of individual development. The delay is analysed as an important feature of foetalization typical of many vertebrate and invertebrate animals. Idealist scientists interpret foetalization in the transition from Neanderthal man to the modern type by analogy with that of the animals.

Dudley Buxton and G. R. de Beer (1932), for example, proceed from the fact that Palestine Neanderthal child's skull Skhul I more greatly resembled that of an adult modern man than the skull of a modern child does that of an adult Palestine man. They assume that the skull of modern man took shape from one similar to that of the Palestine child as a result of an evolutionary process retarding forms at an early

stage in individual development, i.e., a process of pedomorphosis, one that is almost the equivalent of foetalization.

We cannot accept this viewpoint since it is quite impossible to reduce the lengthy historical making of man to purely biological categories. The very great enlargement of the brain, for example, is to a considerable degree due to man's social development. This, in turn, led to a considerable enlargement of the cranium which has given the human skull outward similarity to an infant skull, be it a modern or a Palestine Neanderthal infant.

The view expressed by Buxton and de Beer is closely related to the conceptions of Louis Bolk, a Dutch anatomist and founder of the theory of foetalization, or retardation, in its application to the origin of man. He considers that there are many features in the physical structure of an adult that are due to the process of delay or retardation of a number of organs, among them some of the most important.

In addition to the above-mentioned resemblance of the skull in the large size of the cranium as compared with the facial division, Bolk includes such "infantile" features as certain peculiarities of the body hair. The real causes of such an influence of the external resemblance are not revealed by Bolk who confines himself to a very unsatisfactory indication of the exceptional role played by the incretory glands in the onto- and phylogenic development of man.

Man, like other mammals, possesses glands that discharge their secretions externally such as perspiratory, sebaceous and mammary glands, but there are others that discharge their secretion or hormones into the blood stream. These latter include the epiphysis, hypophysis, thyroid, parathyroid, the suprarenal and sex glands.

The hormones secreted by the cells of any of the endocrine glands penetrate the walls of the tiny capillary blood and lymphatic vessels contained in large numbers in the gland. The hormones enter the blood stream and thus reach the most distant parts of the organism and have a considerable effect on its development, especially on the nervous system.

There can be no doubt that the degree of development of the human body and its various organs to a great extent depends on the normal functioning of the endocrine glands. They must have played a definite role in evolution, although the role was most likely a limited one. Bolk exaggerates the importance of the glands. In this he agrees with Keith (1926) who attributes acromegalic features to the gorilla type of physical structure and resorts to an assumption, unfounded in fact, that these peculiarities are to be explained by the intensified activity of the gorilla's hypophysis.

Human hypophysis diseases cause acromegaly, an enlargement of the tissues of the face, fingers and toes. It has been shown that the gorilla hypophysis is not bigger but smaller than that of a human being. And so Keith could find nothing else to add to his hypothesis than the

statement that although the gorilla hypophysis is small it must have a secretion that is more active. This is contradicted by the fact that the hypophysis of a man suffering from acromegaly increases considerably in size which is contrary to the explanation (given by Keith and Bolk) of the peculiarities of the human type as being primarily due to the incretory system and its functions.

In explaining the phylogenic process by means of foetalization Bolk also proceeds from the unfounded assumption that changes in the endocrine system result from the action of some special principle of directive evolution ascribed to the organic world.

Bolk's hypothesis is closely linked up with orthogenesis, an idealist trend in biology that opposes Darwinism. The explanation of man's evolution exclusively by the peculiarities of endocrine gland development can under no circumstances be deemed satisfactory. The idea is too narrow and one-sided and its incorrect nature is all too obvious (Y. Y. Roginsky, 1933).

The evolution of any vertebrate animal and not of man alone cannot be explained as being determined by any one system of organs. The theory of foetalization as applied to man is, furthermore, an attempt to "biologize" his specific evolutionary path. The course of man's ontogenetic development, moreover, itself underwent some changes, due, in particular, to the intensified development of the brain, the emergence of new physical proportions and the formation of other peculiarities that evolved through the influence of labour and other factors in the making of man.

The external features of similarity with the infant stage of development, that is, some foetalization features, emerged as a result of man's special evolutionary path, when the head, in connection with erect locomotion, was relieved of superfluous muscles and bony ridges. Highly developed erect locomotion typical of modern man was itself the result of the lengthy influence of labour.

The human brain is not retarded at the infant stage and, in the adult, is not an enlarged infant brain. On the contrary, its long period of growth in size and complication is an exception to the general law of early cerebralization that is a typical feature of other mammals whose brains complete their growth at an early age on account of their early maturation. We cannot speak of the foetal nature of the adult brain merely on the basis of its size and shape.

It was because man's immediate simian ancestors possessed a brain that was already at a high stage of development that the formation of a human brain of great intricacy was at all possible. The anatomically and physiologically complicated human brain, however, owes its existence to a still greater degree to man's social life with its labour processes and articulate speech; to this must also be added the influence of a meat diet (F. Engels). As social relations that arose in the course of primitive man's formation grew more and more complicated, those individuals

who possessed the most highly developed brains stood the greatest chance of surviving. But Bolk considers man to be something in the nature of a "neoteinic larva" of the American amphibian, Amblystoma, which, it will be remembered, breeds in the larval stage when it is called the axolotl. Bolk's interpretation of anthropogenesis is tantamount to wiping out the entire history of man's making (M. A. Gremyatsky, 1939).

From this it follows that the explanation of the similarity between the skulls of the Palestine child and the modern adult given by Buxton and de Beer is also unacceptable. Y. Y. Roginsky (1933), in his refutation of Bolk's hypothesis, shows that in the period of embryonic development not only delay but also acceleration of organic development is typical of man, but such conceptions as delay and acceleration are insufficient to characterize the mechanism of the processes taking place during man's formation and that disregard of all connection between the structure of the body and the environment is something that cannot be accepted. The foetalization theory completely alienates form from function. Y. Y. Roginsky justly points out that the theory of human evolution without an ancestor, without a habitat, without erect locomotion and without tools to work with, cannot be regarded as being in any way satisfactory.

Bolk's views on anthropogenesis constitute, if one may so express it, "biologization from within."

There are other scientists whose efforts to explain the origin of man amount to "biologization from without," i.e., they explain man as a purely biological being whose long period of historical development is primarily due to the way in which his natural environment was transformed and not to his social and economic development.

These views, which we term conditionally the geographical conception of anthropogenesis, are widespread among anthropologists and other scientists abroad. The class content of such hypotheses is quite clear; there is a deliberate mixture of natural and social factors and mankind is equated with an ant-hill or beehive or with some colony of gregarious animals, such as the weaver birds that live in large numbers in huge communal nests, or beavers with their dams and houses.

There is no doubt that geographical conditions have an influence on the development of culture, labour techniques, society and on the physical type of man himself. But the question is—how extensive and how profound is this influence, how is it effected and has it been equally strong at all stages of man's making? Could natural conditions have effected the ape-men in the same way as they do modern man? How can one minimize the significance of social surroundings that are second nature specifically for man, and outside of which he cannot continue to exist?

Primitive human society developed on the basis of the production of tools which, to a certain degree, may be regarded as "artificial organs." The making of man was conditioned, on the one hand, by external

influences and, on the other hand, to an incomparably greater extent, by the typical course of society itself, i.e., in the first place by the progressive development of labour processes and the production relations that grew up in the primitive community as a result of that development.

The process of social development became automatic on account of the internal contradictions that were constantly arising due to the incessantly changing relations between the primitive community and nature and being solved by that community. The hunting of the bigger mammals, for example, could only have become possible at a certain stage of technical development. It was a step forward compared with the preceding stage of development when the difference between men and women in acquiring the means of existence had been much less significant. The new methods of obtaining food by hunting big game were mostly applied by the men, while formerly the catching of small animals and the gathering of roots and berries for food were mostly women's occupations. The hunting of medium-sized and big animals gave experience and inventiveness a special significance, since the slightest lack of caution would not only allow the animal to escape, but might lead to the death of the hunters by their being gored by an elephant's tusks or by being crushed under its feet.

While giving the geographical and other natural conditions their proper place, it must always be remembered that they exercised their influence on primitive man through the social medium which may have been weak but was nevertheless qualitatively different from any other medium. Those scientists are sadly mistaken who, like Hans Weinert, believe that the stern conditions of the Quaternary Period with the changes of climate brought about by the ice age were the chief reason for man's high level of development through his cognition of the beneficial effects of fire and clothing.

The ice age made man, said Hans Weinert (1935). This is an example of the wrong way of presenting the question since it mechanically reduces the factors of human evolution to the influence of external media (A. N. Yuzefovich, 1937).

Actually Weinert is merely repeating the old views expressed by the evolutionist Moritz Wagner (1813-1887). Wagner believed that man's descent from the anthropoids was due to the influence of the ice age (although we must point out that in 1871 this scientist indicated the important role of the artificial fabrication of tools in the process of anthropogenesis).

Weinert regards the use of fire as the integral element in man's makeup that must be given first place. Although fire is typical of primitive man (even for the Sinanthropus), it was not only the primitive people living in cold climates that were acquainted with it, but also those who had their habitat in warm countries where in many places it is damp at night and where it is often cold in the rainy season. There is no reason

to believe that primitive man discovered fire only as a result of the ice age. Nor can one deny the fact that the conditions engendered by the ice age were a strong stimulus to the development of man in those regions where he felt its influence. Some human groups may have proved unable to withstand the cold and have perished.

G. V. Plekhanov (1856-1918) also attributed too great a role to geographical conditions. He believed that it was only the conditions of the geographical environment that enabled our anthropomorphous ancestors to reach that high level of intellectual development that was necessary for them to become tool-making animals.

We may judge the extent to which Plekhanov over-estimated the importance of geographical conditions from the fact that he considered that this environment first and foremost conditioned the development of the productive forces on which the further development of economic and all other social relations depend. He maintained that the development of social and economic relations is, in the final analysis, determined by the nature of the geographical environment.

This is a case of the over-estimation of the significance of geographical conditions, a mechanical reduction of the process of anthropogenesis and the adaptation of man's ancestors to the effect of purely external conditions. In other words, the attribution of primary importance to geographical factors minimizes the role of social influences.

Marx, in his *German Ideology*, poses the question correctly: "The first requisite for all human history is, naturally, the existence of living human individuals. The first fact to be established, therefore, is the physical organization of these individuals and the relations with all other natural forces that it conditions. It goes without saying that we cannot here deal with the physical qualities of man himself nor with the natural conditions, geological, oro-hydrographic, climatic and other natural conditions as man found them. All history must proceed from these natural fundamentals and modifications due to the activity of man in the course of history."*

In this statement Marx gives primary importance to those activities of man that brought about changes in natural conditions and in the physical peculiarities of man himself. The same geographical conditions play an entirely different part at different levels of the productivity of economic forces; the oceans formerly separated peoples and hindered their development, but with the progress of navigation they began to unite mankind and facilitate social and economic advancement.

The significance of geographical conditions in human evolution, therefore, must not be exaggerated, they must be given their proper, subordinate place in the analysis of the motive forces of anthropogenesis. The external influence of natural conditions must be combined with the developmental factors of society itself.

---

* Translated from Marx-Engels, *Gesamtausgabe*, Band 5, Abt. 1, S. 10.

The rapid progress made by mankind in the last few millennia and in the present historical epoc is positive confirmation of the fact that society can go through a number of radical changes, while the external environment and the human physique itself remain almost unchanged. In any case, the changes are infinitely small when compared to the transformations that have taken place through social development.

Comparatively small changes in the structure of the primitive community at the earliest stages of its development, on the contrary, brought about far more significant changes in the human organism since completely new conditions of social labour had a direct determining influence on the way in which the human body was reconstructed: the human organism was still to a large extent simian and far from sufficiently well adapted to labour processes that, in their turn, were constantly acquiring new forms.

Without going into the details of other bourgeois conceptions of the making of man we must say that, as Engels wrote, if even the materialist-minded naturalists of the Darwin school could not see the decisive role of labour on account of thousands of years of idealist philosophy, it is no wonder that the works of a large number of biologist and anthropologists abroad are saturated with idealism. Furthermore, we must stress the point that all such conceptions of anthropogenesis, in particular those that are formally genetic, inevitably lead to racist views on mankind and the races of mankind.

Stalin allots the chief role to the organs of locomotion, the speech apparatus and the brain in the making of man, and his views on this subject are of interest from the standpoint of the problem of anthropogenesis.

"If the ape had always walked on all fours, if it had never stood upright, its descendant—man—would not have been able freely to exercise his lungs and vocal chords and, therefore, would not have been able to speak; and this would have fundamentally retarted the development of his consciousness. Or put it another way: if the ape had not risen up on its hind legs, its descendant—man—would have been compelled always to walk on all fours, to look downwards and obtain his impressions only from there; he would have been unable to look up and around himself and, consequently, his brain would have obtained no more impressions than the brain of a quadruped. All this would have fundamentally retarded the development of human consciousness.

"It follows, therefore, that the development of consciousness needs a particular structure of the organism and development of its nervous system."*

The beginnings of labour activity among highly developed anthropoids such as man's Upper Tertiary simian ancestors is quite conceivable even if their mode of locomotion was still half quadruped. We know, for

* J. V. Stalin, *Works*, Vol. 1, Moscow 1952, p. 316.

example, that the little Javanese monkeys, the crab-eaters, use stones to break open the crabs and shellfish they use for food. They come down from the trees and on the seashore or river-banks, pick up small stones to use as tools and then throw them away. Such actions are what Marx called "an embryonic form of labour."

One can easily imagine anthropoid apes of the Australopithecoid type or pre-hominids, who were compelled to seek food in the open plains or savannahs, adopting various methods of obtaining food including the use of stones in the way the Javanese monkeys do. Since the brain of the anthropoid is much more highly developed, these prehuman forms of labour could easily have developed further, provided the necessary conditions obtained.

A recently published report from Liberia tells of a male chimpanzee who brought the branch of an oil palm to a cliffside and there broke open the nuts with a stone.

Probably some ancient terrestrial anthropoid apes, half quadruped and half biped, could have taken to the regular preparation of primitive tools. They would then have developed into ape-men and would probably have remained at the very lowest cultural level to the present day. If, however, their labour was accompanied by a transition to erect locomotion, they would have been able to develop articulate speech and human consciousness through the necessity to perform collective labour activities. For, as Engels pointed out, the transition to erect locomotion was a decisive step forward in humanizing the ape. Only beings of the ape-man type could have developed on Earth without erect locomotion and they could never have reached a higher stage. One of the most important tasks confronting Soviet anthropology, therefore, is the profound study of the process of development of erect locomotion, the speech apparatus and the brain in man's ancestors, i.e., of men-in-the-making, and of modern man.

3. THE RACES OF MANKIND

The population of the world today is approximately 2,800,000,000 people. In the primary and secondary features of their external aspect and internal structure they all very closely resemble each other. For this reason the majority of scientists, from the biological standpoint, place all mankind in one species, *Homo sapiens*.

Mankind, now occupying almost all the dry land (fig. 160), even Antarctica, is not homogeneous but consists of groups that have long since been given the name of races, a term that has become fixed in anthropology.

A race of mankind is a biological group of people analogous but not homologous to a subspecies group in zoological classification. Each of the races has a common origin and emerged on a definite territory, its original habitat. Each race is characterized by a certain set of physical

peculiarities, mostly the outward appearance, morphology and anatomy of its members.

The chief racial distinguishing features are: the nature of the hair on the head; the nature and development of facial hair (beard, moustache) and body hair, the colour of the hair and skin and the iris of the eye, the shape of the eyelids, nose and lips, the shape of the head and face and the length of the body, or height of the individual.

The races of mankind are the subject of special anthropological study. In the opinion of many Soviet anthropologists mankind today consists of three great races each of which is divided into a number of smaller races. These latter are again subdivided into groups of similar anthropological types which constitute the basic unit in anthropological systematics (Cheboksarov, 1951).

Within any of the races of mankind individuals are to be found that are more typical and those that are less typical. There are also races that are more characteristic, more strongly expressed as well as those that differ little from other races. Some of the races are of an intermediate character.

The Negroid-Australoid (black) great race as a whole is characterized by a definite complex of features that is most strongly expressed in the Negroes of the Sudan and which distinguishes it from the other two great races, the Europeoid and Mongoloid (fig. 161). Among the racial features of the Negroid race are: black hair, in tightly coiled spirals or wavy; chocolate-brown or even almost black (but at times yellow-brown) skin; brown eyes, a somewhat flattened nose that does not protrude, has a low bridge and wide nostrils (some types have straight, narrower noses); the majority have thick lips; very many have long heads; the chin is moderately developed; the parts of the maxillary and mandible holding the teeth tend to protrude (mandibular prognathism).

On account of the geographical distribution of the Negroid-Australoid race it is sometimes called Equatorial or Afro-Australasian. The race is divided naturally into small races: 1) the western, or African, also called the Negroid race, and 2) the eastern, Oceanic, or Australoid race.

Another complex of features is typical of representatives of the big Europo-Asian, or Europeoid (white) race. They are: pinkish skin due to the blood vessels showing through it; some have fair skin, others have a darker tone of skin; many have blond hair and light eyes; the hair is wavy or straight and has medium or strong development on the face and body; the lips are of medium thickness; the nose is thin and projects sharply from the facial region; the bridge of the nose is high; the folds of the eyelids are poorly developed; the jaws and upper part of the face do not project greatly and there is a medium or strongly projecting chin; as a rule the face is not very broad.

Within the Europeoid great race (white) three smaller races are defined by the colouring of the hair and eyes: the clearly expressed northern (blond) and southern (brunette) and the less clearly expressed middle-

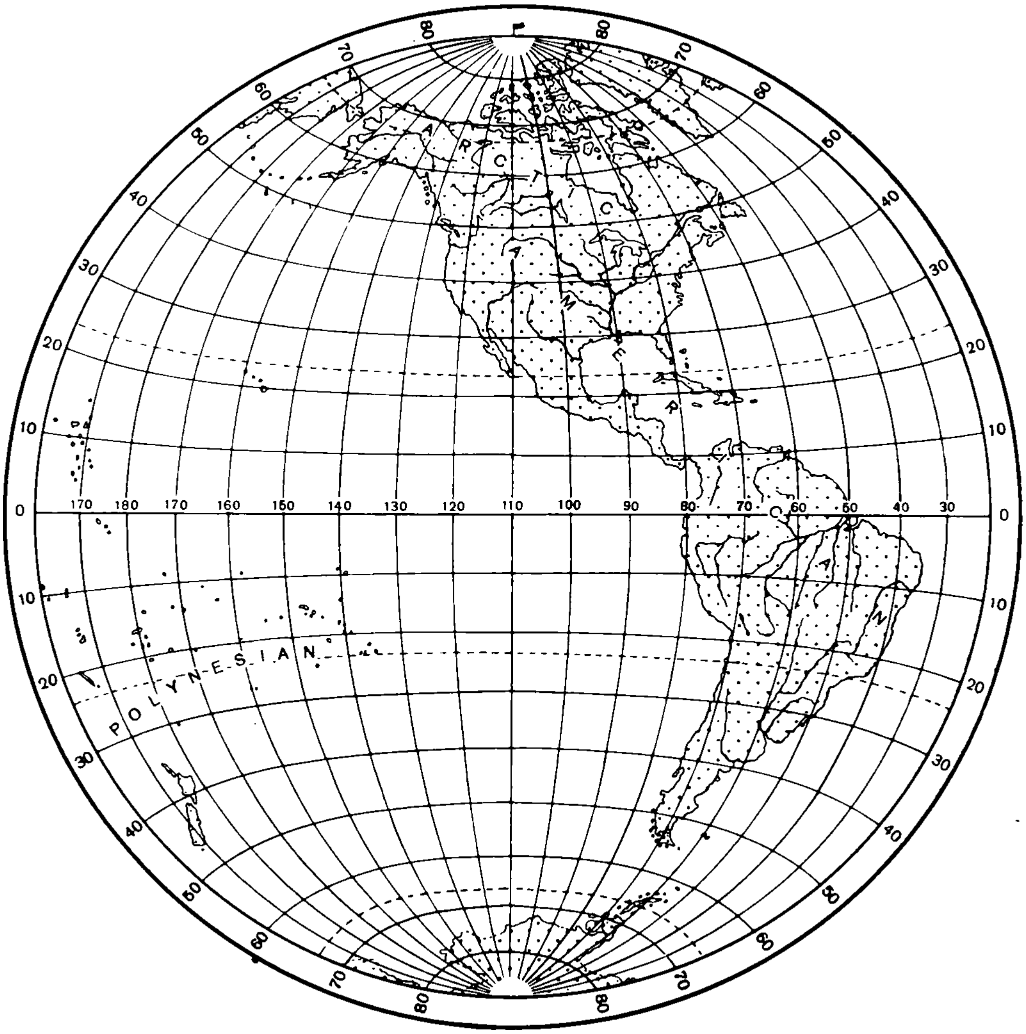
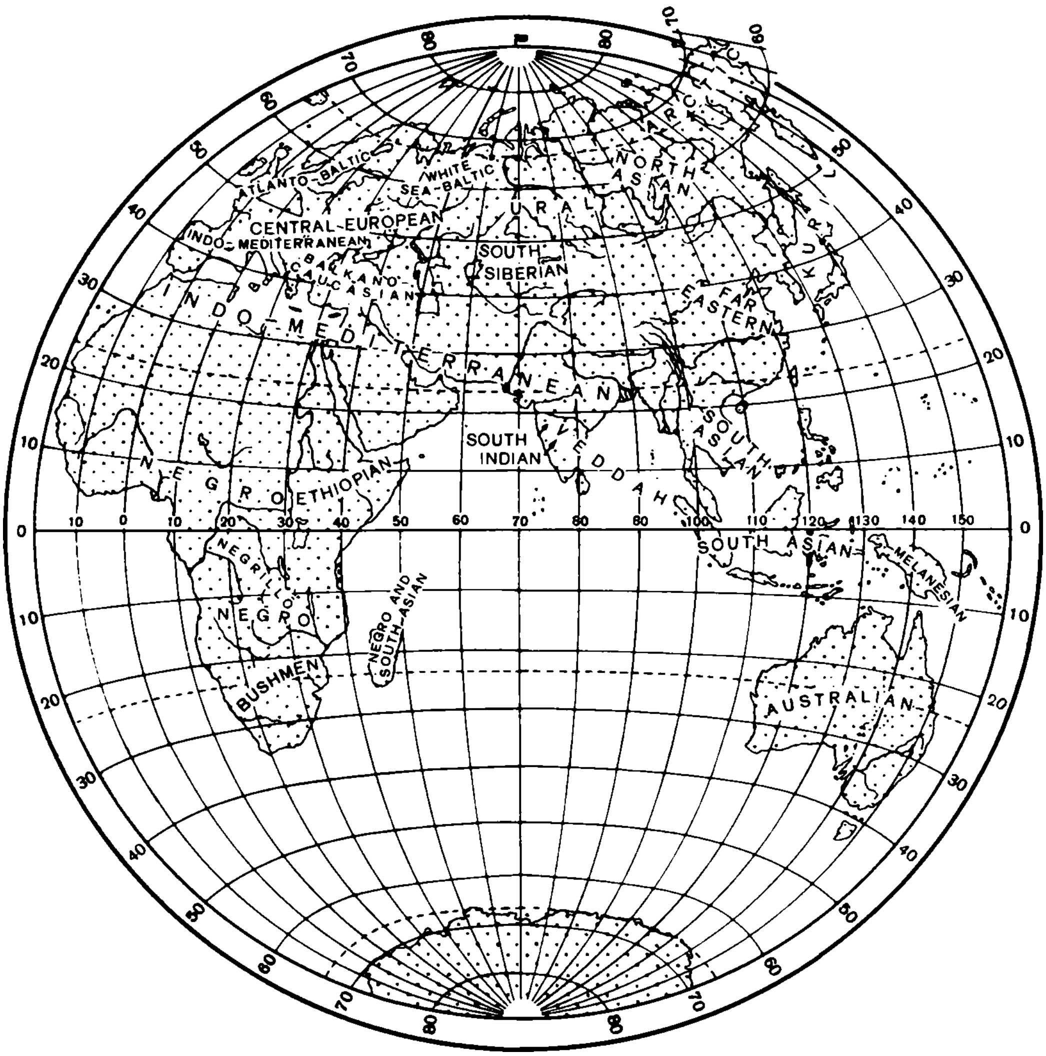


Fig. 160. Distribution of
After Y. Roginsky

European with intermediate colouring. A considerable part of the Russians belongs to the White Sea-Baltic type group of the northern minor race. Typical for the Russians are light brown or blond hair, blue or grey eyes and very fair skin. Furthermore, the nose is frequently retroussé and the bridge is not so high and is of a different shape from that of the north-western Europeoid type, the Atlanto-Baltic group, representatives of which are found mostly in the North European countries. The White Sea-Baltic group has many features in common with the latter group and together they form the North European little race.

The brunette group of the southern Europeoids is made up of most of the inhabitants of Spain, France, Italy, Switzerland, South Germany and the Balkan countries.



races of mankind.
and M. Levin, 1955.

The Mongoloid, or Asio-American great race (yellow) has a complex of features that distinguishes it from the Negroid-Australoid and Europeoid races: the majority of the representatives of the race have dark or yellowish skin; the eyes are dark brown; the hair on the head is black, straight and stiff; as a rule the beard and moustache do not grow; there is very little hair on the body; typical of Mongoloids is the peculiar arrangement of the epicanthus, or fold in the eyelid, which covers the inner angle, or canthus, of the eye, giving it an appearance of slant; the face is rather flat; the cheek-bones are placed widely apart; the chin and the jaw do not greatly protrude; the nose is generally straight but the bridge is low; the lips have medium thickness; the majority are of less than average height.

Fig. 161. Representatives of races of mankind:
1—Europeoid; *2*—Negroid; *3*—Mongoloid. Archives of Institute of Anthropology, Moscow State University.

The full complex of these features is met with most frequently among the northern Chinese who are typical Mongoloids but are taller. Other Mongoloid groups have thicker or thinner lips, hair that is not so stiff and they are less than average height. The Red Indians of America occupy a special place, for they have many features that approximate them to the great Europeoid race.

The human race also contains groups of mixed origin. One of these is the Lapland-Urals group to which belong the Lapps with their yellowish skin and soft, dark hair. The physical peculiarities of these inhabitants of the extreme north of Europe combine features of the Europeoid and Mongoloid races.

There are also groups possessing great similarity with two other, clearly distinctive races; this similarity is not so much due to crossing as to ancient relationship. An example is the Ethiopian group of types that combine features of the Negroid and Europeoid races; it has the character of an intermediate race. The Ethiopian is apparently a very ancient group. The combination of two great races in this group is clear evidence of the fact that in the very distant past these two great races were onsingle unit. Many of the inhabitants of Abyssinia belong to the Ethiopian group.

In general, the human race is divided into some twenty-five to thirty groups of types. Nevertheless, the human race is a single unit since there are intermediate (transitional) or mixed groups of anthropological types between the great races.

The majority of the races of mankind and the groups of types each occupy a definite common territory on which that section of mankind emerged and developed historically.

There have been many cases when some part of a certain race, on account of the historical conditions obtaining, has migrated to neighbouring

or even to distant countries. In some cases races have completely lost contact with their original habitat or a considerable part of them has been annihilated.

As we have seen, approximately the same combination of inherited physical peculiarities in their outward appearance is characteristic for most representatives of any one race. It has been established, however, that racial features undergo change both in the course of individual development and in the course of evolution.

Representatives of any one of the human races have, on account of their common origin, greater resemblance to each other than to representatives of other races.

There is great individuality among the members of a racial group and the boundaries between the different races are not usually clearly defined. In this way one race is connected with another by a series of unnoticeable transitions. In a number of cases it is difficult to determine the racial composition of the population of some country or of a whole group of populations.

The determination of racial characteristics and their individual variations is made with the aid of special instruments and by methods elaborated by anthropologists. As a rule, hundreds and even thousands of representatives of the racial group being studied are measured and examined. This method provides a quite accurate picture of the racial composition of any people, the degree of purity or mixture of racial types, but does not allow for some individuals to be ascribed to a definite race. This is on account of racial characteristics being weakly expressed in the given individual or because the individual is the result of some crossing.

In a number of cases racial characteristics undergo variations even in the course of one lifetime. Sometimes racial subdivisions change their specific features within a short period. Within the last few hundred years, for example, many human groups have changed the shape of their heads. Franz Boas, a prominent progressive American anthropologist, has established the fact that the shape of the skull changes inside racial groups in a much shorter period of time, for example, when they migrate from one part of the world to another, as was the case with immigrants into America from Europe.

Individual and general types of racial change are intimately connected and lead to a continual, even if scarcely noticeable, modification of the racial groups of mankind. Although the hereditary composition of the races is fairly stable, it is subjected to incessant change.

So far we have spoken more of racial differences than of similarities between races. Let us, however, remind the reader that the differences between races are only clearly marked when comparison of the whole complex of them is made. If each of the racial features be examined separately, we find that very few of them can serve as more or less reliable evidence that the individual belongs to a definite race. In this respect,

perhaps, the most outstanding racial feature is the tight spiral curls of black hair common among typical Negroes.

In very many cases it is absolutely impossible to say to which race an individual belongs. A fairly aquiline nose with a bridge of medium height and nostrils of medium width is to be found in some groups of all three great races; the same applies to many other racial features. This does not in any way depend on whether or not the individual in question results from a marriage between representatives of two races.

The fact that racial characteristics intertwine is one of the proofs that the races have a common origin and are related by blood to each other.

Racial differences are usually secondary or even tertiary features of man's physical structure. Some of the racial features, the colour of the skin, for example, are due to the ancient adaptation of the human organism to its environment. These features evolved in the course of mankind's historical development but they have now to a great extent lost their biological significance. In this respect the races of mankind in no way resemble the subspecies of the animal kingdom.

Racial differences in wild animals emerge and develop as their organisms adapt themselves to the natural environment in the course of natural selection, in the struggle between mutation and heredity. The subspecies of wild animals, in the course of lengthy or rapid biological evolution, can and do develop into species. Subspecies peculiarities are a vital necessity to wild animals as they bear the character of adaptation.

Breeds of domestic animals are created by means of artificial selection: the most useful or the most beautiful individuals are chosen to found the herd. The development of new breeds on the basis of I. V. Michurin's theories is often carried out in a very short time, in the course of a few generations, especially when it is combined with correct feeding.

Artificial selection played no part at all in the formation of the modern races of mankind; natural selection was only of secondary importance and has long since ceased to be even that. It is obvious that the origin and development of the races of mankind differ very greatly from the ways in which breeds of domestic animals have been evolved, to say nothing of cultivated plants.

The basis for a scientific conception of the origin of the races of mankind from a biological standpoint was first laid down by Charles Darwin. He made a special study of the races of mankind and established the very great similarity of many basic features and their close, blood relationship. This, said Darwin, was evidence that they all branched off from the same common trunk and did not have different ancestors. The further development of science has fully confirmed this view which is the basis of monogenesis. The theory that mankind descended from a number of different apes, i.e., polygenesis, is, therefore, unfounded, so that racism loses one of its main bulwarks (Y. Y. Roginsky, M. G. Levin, 1955).

What are the specific *Homo sapiens* features that are common to all races of mankind without any exception? The fundamental, primary features are a big, well developed brain with a large number of convolutions and furrows on the surface of its hemispheres and the human hand which, according to Engels, is both the instrument and the product of labour. Typical also is the human foot with its longitudinal arch that is capable of supporting the body when standing or walking.

Other important features distinguishing modern man are: a vertebral column with four curvatures of which the most specific is the lumbar curvature that developed as a result of erect locomotion; a skull with a rather smooth exterior, a highly developed cranium or brain-case and a weakly developed facial skeleton with high frontal and parietal regions of the cranium; strongly developed gluteal muscles and also strong femoral and tibial muscles; poorly developed body hair and the complete absence of vibrissae or bunches of feelers in the brows, moustache and beard.

All the present races of mankind possess the above features and stand at the same high level of physical organization. Although all these species peculiarities are not developed equally in all races, although some are more vigorously and others more weakly developed, there are no very great differences: all the races possess all the features of modern man and not one of them can be described as Neanderthaloid. There is no one race of mankind that is biologically superior to any other race.

Nevertheless, bourgeois reactionary scientists and publicists continue to preach the biological inequality of the races of mankind. In most cases they maintain that the brains of some races, which they term the "lower races," are more ape-like than those of the other, "higher" races. This is absolutely false. Studies made by Soviet anthropologists show that there is no significant difference in the brain structure of representatives of the various races (Y. G. Shevchenko, 1956). The racist theories are also contradicted by the fact that all the races of mankind are equally well adapted to erect locomotion and to labour activity. In view of the existence of such features of similarity between the races there is absolutely no basis for the assertion that any of the races is closer to the ape than the others (M. F. Nesturkh, 1958).

The modern races of mankind have lost the many simian features that the Neanderthalers still possessed and have acquired the features of *Homo sapiens*. None of the modern races, therefore, can be regarded as more simian or more primitive than the others.

Those who support the false theory of higher and lower races maintain that Negroes are more simian than Europeans. From the scientific point of view this is quite untrue. Negroes have tightly curled hair, thick lips, the forehead is straight or bulging, there is no tertiary hair on the face or body, and the legs are very long relative to the trunk. These are all

features that show that the Negro is farther removed from the chimpanzee than the European is. But the European, in his turn, differs very greatly from the apes on account of his light skin and other features. Darwin's theory of the descent of man from one species of ancient anthropoid ape and Engels' theory of the transition from ape to man under the influence of social labour help us get a clearer understanding of the question of the races of mankind. Scientific data permit of only one correct conclusion that all modern human races are derived from one single stem under the combined influence of biological and social laws.

Throughout the million years or so that have elapsed since the beginning of the Quaternary Period, during its glacial and interglacial epochs and up to the postglacial, present epoch, primitive man spread further and further over the world. The development of groups of men often took place in different, isolated regions where they developed under the influence of local natural conditions. Here we must make mention of the role of natural and sexual selection in the making of primitive man. The most ancient men became Neanderthalers and these then became Cro-Magnon people. Races were not only constantly arising, but were also constantly being levelled out. While differing from each other on account of differences in the geographical conditions in which they lived, the races, under the influence of labour, the development of culture and other special factors, grew more and more to resemble each other in the general features of the modern type of man. On account of their qualitatively different path of development the races of mankind began to differ qualitatively more and more greatly from the subspecies of the animal kingdom.

The study of the bone remains of Old World Neanderthalers and fossil men of the modern type has led some scientists to believe that about 100,000 years ago there were signs of two great racial divisions within primitive man (Y. Y. Roginsky, 1941, 1956).

One of the big primitive racial groups took shape in the north-eastern half of Asia, to the north and east of the Himalayas. This was the proto-Asian or proto-Mongoloid great race from which emerged several Mongoloid minor races and anthropological groups.

The Mongoloid racial group that much later, 25,000-30,000 years ago, crossed what was then an isthmus and the Aleutian Islands into America, also branched off from the proto-Mongoloid great race. This group spread further and further southwards and in the course of time developed into the Red Indian or American minor race that scientists usually divide into several groups of anthropological types.

Another great branch of the human race was the south-western; it split into two primary great racial groups—the Eurasian or Europeoid and the Equatorial or Negroid-Australoid.

One of the most significant distinguishing features marking these two great south-western races is the colour of their skin that became fixed in the process of their development in different directions. At the present

moment the skin is darker among representatives of the Negro-Australoid race and of those Europeoid races that live in the hotter countries of the south. The Europeoid groups that live in the more northerly countries have gradually acquired a lighter skin. It is believed that first the skin grew fairer and was followed by the eyes and finally the hair.

The isolation factor played an important part in the development of races of primitive man. As they spread over the Earth small groups that were physically similar, found themselves in regions with completely different natural conditions. When they settled in their districts for a long time, they were unable to make contact with other groups, and it is perfectly natural that in thousands and tens of thousands of years of isolated existence, under the influence of local natural and social conditions, the anatomical and physiological peculiarities of the groups should have developed in different directions. Under these circumstances even slight changes in physical structure, that all went in the same direction, accumulated from generation to generation and were consolidated. The various groups began to differ more sharply from each other, mainly in a number of external features that acquired no small significance as the distinguishing features of tribal relationship.

Even in modern mankind the process of race formation under the influence of natural isolation is still to be seen in some parts of the world. This apparently accounts for the formation of anthropological types and groups on the frontiers of the areas settled by man, on the outskirts of the Greek *oecumene*, whose complex of racial features clearly distinguishes them from all others. Among racial groups of this type, for example, are the North European Lapps, the Eskimos (Innuits) of the extreme north of Asia and America, the people of Tierra del Fuego in the extreme south of South America, the Australian aborigines, the Papuans of New Guinea, the Bushmen of the Kalahari and Namib deserts and the Negrillo Pygmies in the dense tropical jungles.

In the most distant times, however, there was a progressive development of human society, even if it was still a very slow one, productive forces grew, the groups of human beings became stronger numerically, and some races began to make more frequent contacts with others. Human groups now began to mix more freely and crossing instead of isolation became the deciding factor in the appearance of new races. But the influence of this factor has more frequently led and is still leading to the formation of racially mixed groups.

The beginning of the process of racial crossing coincided with the final stage of basic processes of the making of man, i.e., with the appearance of men of the modern type. The high degree to which the human body had become adapted to labour activity facilitated the emergence of a single physical type of modern man and the levelling of racial differences.

In the course of time the various races have undergone a considerable degree of intermingling (fig. 162). This process of racial crossing has been

Fig. 162. Crossing of races of mankind:
1—Europeoid-Negroid; *2*—Europeoid-Mongoloid; *3*—Negroid-Mongoloid. After E. Fischer, 1913 (*1* and from Archives of Institute of Anthropology, Moscow State University (*2, 3*).

especially intensive during the past 10,000-15,000 years. From the time Christopher Columbus discovered America in 1492 the crossing of racial types has assumed tremendous proportions so that "pure" races are not to be found anywhere. All mankind is to a greater or lesser degree of mixed race: there are tens of millions of people in the world today that cannot be ascribed with certainty to any one of the great races.

The greater blood relationship between people as a result of their crossing has greatly reduced the physical differences between them. The crossing of races has undoubtedly played a positive role in the development of mankind and has helped unite man into a single biological entity that is qualitatively very different from that species of higher anthropoid that served as the ancestor of the earliest man.

That which we have said confirms the thesis propounded by Marx and Engels that racial differences must and will be eliminated in the course of man's historical development.

All the human races cross easily and produce fertile, normal and healthy progeny. In a number of cases generations of mixed race have resulted in improved physical qualities and greater beauty. The proposition fundamental to Soviet anthropology, i.e., that all the modern races of mankind are biologically equal, is greatly strengthened by these facts.

The science of the origin and development of the races of mankind completely undermines the false misanthropic theories of the existence of higher and lower races. Soviet anthropology is a genuine materialist science that upsets the inventions of the racists concerning the existence of some chosen Aryan race or a hundred-per-cent pure American white race whose vocation is to subordinate all other peoples and races to itself and to rule over them by reason of its "natural" physical and spiritual "superiority."

4. SCIENCE AGAINST RACISM

The founders of Marxism-Leninism, who elaborated a genuinely scientific concept of social development, showed convincingly that racial divisions do not and cannot play anything like an important role in the development of mankind.

Marx and Engels established the fact that the history of human society, beginning from the slave-owning societies, is essentially the history of the class struggle. The pseudo-scientists, the ideologists of imperialism, strive to prove that the struggle between races and not between classes is basic in human history.

When reactionary scientists substitute the struggle between races for the class struggle as the chief motive force in history they are consciously falsifying history.

The legend of higher and lower races is no new one. Even in times of antiquity a people that had gained victory in war would often declare itself the higher race and the people that had been defeated a lower race, as an excuse to exploit or annihilate the latter.

The false idea of racial superiority, born of the exploitation of people, began to take on a pseudo-scientific form in the eighteenth century. As early as 1786 in Germany the idea of racism was preached at Göttingen University by Professor Christopher Meiners who placed the "white" race higher than the "coloured" races and the Celtic race higher than the Slavs.

In the nineteenth century the racists were strongly supported by the writings of such pillars of racism as Gobineau, Lapouge, Ammon and Woltman, whose pseudo-scientific works, frequently of many volumes, attempted to give a basis to the theory of higher and lower races.

The supporters of the racist theory preach such reactionary ideas as the primary division of mankind into higher and lower racial groups; the ancient, inborn aristocratic nature of the ruling classes; the necessity for maintaining the purity of the higher race; the need for the propagation and perfection of the higher race; the planned mass destruction (genocide) of the lower race. The racists make extensive use of the Malthusian idea of "overpopulation."

Real knowledge defeats the inventions of the racists. The very concepts of racism are far removed from science. It has been firmly established that there are fundamental similarities in the inborn anatomical and physiological peculiarities of all human races. One of the best proofs of this is Darwin's study of the people of Tierra del Fuego.

When Darwin first saw these Indians, they created a great impression on him by their outward appearance and he described them as people whose cultural level was very close to that of the ancestors of modern man. After a closer study, however, he was amazed at their great resemblance to Englishmen in the basic lines of their behaviour and the character of their mental abilities.

Darwin drew the conclusion that the Indians, Negroes and representatives of other races had fundamental similarity with the Europeans in the basic features of their psyche, their inclinations and habits. He based his conclusions on the fact that, judging by the shape of stone arrowheads gathered from various countries and belonging to various epochs of human prehistory, methods of fabricating them were amazingly similar. N. N. Miklukho-Maklai, who was very closely acquainted with the Papuans and other peoples of Oceania, stressed the point that the cardinal features of their psyche were basically the same as those of Europeans (N. N. Miklukho-Maklai, 1950-1954).

In view of these real scientific data the assertion made by the racists that the Aryan race is psychologically superior to all others is absolutely without foundation.

The level of a people's culture has nothing to do with racial composition. It depends on the sum total of social and natural conditions of the historical development of peoples and states and their alliances.

Scientifically established facts and everyday experience contradict the racist contention that the culture of the European peoples and their languages are born of the Aryan racial spirit. It is well known that the division of peoples by languages does not coincide with their division into races. Languages and races develop independently of each other.

The falseness of the racist theory that there is a connection between race and language is amply proved by material taken from the lives of the peoples of the U.S.S.R. There are many nations and tribes in our country speaking Turkic languages. Some of them are Europeoid racial types (Azerbaijanians), others are Mongoloid (Kazakhs, Kirghiz and Yakuts) while the third are a mixture of Europeoid and Mongoloid (Shortzy, Bashkirs, Tatars).

It is also true that the concepts "race" and "nation" are quite different. Everybody knows that the English nation contains representatives of various Europeoid races. The German nation contains representatives of at least five racial groups. The population of the U.S.A. is a conglomeration of the most varied racial types represented by immigrants from Europe, Africa and Asia. Such facts are due to the terms "race" and "nation" representing completely different categories whose coincidence is an exception and not a rule.

It is, therefore, incorrect to speak of the English, German, French or Slavic races in the way the racists frequently do. Still more incorrect is it to speak of an Aryan race, since the term "Aryan" is taken from the sphere of linguistics and signifies a special group of languages. The races have their own names and they must not be confused with the names of languages.

The racists, in interpreting history as a struggle between races, often speak of a yellow or black peril for the Europeans. It is not, however, any specific race that is likely to be an aggressor, but only an imperialist

state or group of states. Lenin, in his time, gave a very instructive rebuff to those who mix these different concepts.

At the turn of the century the Chinese people raised the famous I-he-chuan ("Boxer") rebellion against foreign capitalists, and the columns of the bourgeois press were filled with articles about the yellow peril to European culture and civilization, about the "savage yellow race" and about the hatred of the yellow for the white race. In his analysis of the Chinese popular uprising and its suppression by foreign troops, Lenin exposed the class nature of the artificially created enmity between peoples.

"Yes!" wrote Lenin, "the Chinese do detest Europeans, but what Europeans, and what for? It is not the European peoples that they hate—they have had no conflicts with them—but the European capitalists and their subservient governments."*

The two world wars that have occurred during the first half of the twentieth century resulted from attempts made by German imperialism to seize new colonies and conquer the territories of neighbouring states. One of the specific features of German imperialism was its racial policy, its misanthropic ideology.

Fascist Germany declared the North European race, the "Aryan race" in the terminology of the Nazi ideologists, to be the higher race, although in Germany it is represented by a very small group. Among the populations of the surrounding countries there are just as many, if not more, people with fair hair and eyes, as there are in Germany. The declaration that the "Aryans" are a higher race has no foundation in genuine science and is of a political, extremely reactionary character (M. S. Plisetsky, 1955; M. F. Nesturkh, 1942, 1954; Y. Y. Roginsky, M. G. Levin, 1955).

Under the banner of pseudo-scientific racism the Nazis preached their ultra-imperialist plans for the subjugation of mankind and fostered dreams of conquering the whole world. Racism was nothing more than a screen for the Nazis with which to cover their imperialist policy: it served as the ideological basis for their programme of exploitation and annihilation of non-German peoples.

The equality of races and nations is one of the most important elements of the moral strength and might of the Soviet state. Soviet anthropology provides scientific data on the racial composition and history of the origin of the peoples of the different countries. It develops the one correct concept that all the races of mankind are biologically equal. The genuinely materialist conception of the origin of man and of races serves the struggle against racism, against all idealist, mystic conceptions of man, his past, present and future.

* V. I. Lenin, *The Chinese War*, see *The National-Liberation Movement in the East*, Moscow 1957, p. 4.

BIBLIOGRAPHY

K. Marx, *Capital*, Vol. 1, Moscow 1958.

K. Marx and F. Engels, *Selected Works*, Two-vol. ed., Vol. II, Moscow 1958.

Marx-Engels, *Selected Correspondence*, No. 52, Moscow 1955.

F. Engels, *Herr Eugen Dühring's Revolution in Science*, Moscow 1954.

F. Engels, *Dialectics of Nature*, Moscow 1954.

Ленин, В. И. *Государство и революция*. Соч., 4 изд., т. 25, стр. 361.

Ленин, В. И. 1951. *Китайская война*. Соч., т. 4. М., Госполитиздат, стр. 347—352.

Ленин, В. И. 1948. *Крах II Интернационала*. Соч., т. 21. М., Госполитиздат, стр. 181—232.

Алексеева, Л. В. 1949. *Половые циклы приматов и поведение. Сообщение 1. Половая кожа и структура полового цикла*. „Рефераты научно-исследовательских работ Акад. мед. наук СССР", вып. 7 (медико-биологические науки).

Алексеева, Л. В. и Нестурх, М. Ф. 1958. *Морфо-физиологические особенности полового цикла у обезьян*. „Советская антропология", т. 2, № 3.

Алексеева, Л. В. 1954. *Изменения состава красной крови и веса тела у обезьян-самок в связи с половыми циклами*. „Бюллетень экспериментальной биологии и медицины", № 1.

Амлинский, И. Е., 1955. *Жоффруа Сент-Илер и его борьба против Кювье*. М., Изд-во АН СССР.

Анучин, Д. Н. 1922. *Ископаемый человек в Азии и Африке*. „Новый Восток", № 2.

Анучин, Д. Н. 1923. *Находка неандертальского черепа в южной Африке*. „Русский антропологический журнал", т. 12, кн. 3—4, стр. 83—84.

Аристотель. 1937. *О частях животных*. Перевод с греческого, вступительная статья и примечания В. П. Карпова. М., Биомедгиз.

Аристотель. 1940. *О возникновении животных*. Перевод с греческого, вступительная статья и примечания В. П. Карпова. М., Изд-во АН СССР.

Астанин, Л. П. 1952. *Влияние физических упражнений на пропорции руки человека*. „Природа", № 6.

Бадер, О. Н. 1936. *Новая палеоантропологическая находка под Москвой*. „Антропологический журнал", № 4.

Бадер, О. Н. 1940. *Находка неандерталоидной черепной крышки человека близ Хвалынска и вопрос о ее возрасте*. „Бюллетень Московского общества испытателей природы" (Отдел геологический), т. XVIII, № 2, М.

Белова, Т. И. и Хрисанфова, Е. Н. 1957. *Линии расщепления на черепе человека и обезьян*. „Советская антропология", т. 1, № 2.

Белова, Т. И. 1958. *Архитектоника прецентральной области коры головного мозга высших обезьян и человека*. „Советская антропология", т. II, № 3.

Белова, Т. И. и Хрисанфова, Е. Н. 1958. *Линия расщепления на скелете человека и обезьян*. „Советская антропология", т. II, № 3.

Бибиков, С. Н. 1929. *Грот Мурзак-Коба—новая позднепалеолитическая стоянка в Крыму*. „Советская археология", № 5.

Бибиков, С. Н. 1940. Из работ Крымской палеолитической экспедиции 1936 года. „Бюллетень Комиссии по изучению четвертичного периода“, № 6—7, М.—Л., Изд-во АН СССР.

Блинков, С. М. 1955. *Особенности строения большого мозга человека. Височная доля человека и обезьян.* М., Медгиз.

Бонч-Осмоловский, Г. А. 1940. *Грот Киик-Коба.* „Палеолит Крыма“, вып. 1, М.—Л., Изд-во АН СССР.

Бонч-Осмоловский, Г. А. 1941. *Кисть ископаемого человека из грота Киик-Коба.* „Палеолит Крыма“, вып. 2, М.—Л., Изд-во АН СССР.

Бонч-Осмоловский, Г. А. 1954. *Скелет стопы и голени ископаемого человека из грота Киик-Коба.* Ред. и дополн. В. В. Бунака. „Палеолит Крыма“, вып. 3, М.—Л., Изд-во АН СССР.

Борисковский, П. И. 1950. *Начальный этап первобытного общества.* Л., изд-во Ленинградского государственного университета им А. А. Жданова.

Борисковский, П. И. 1956. *Современная наука о происхождении человека,* Л., Лениздат.

Бочкарев, П. В. 1935. *Влагалищный цикл и течка у приматов.* „Архив биологических наук“, т. 40, вып. 2.

Бунак, В. В. 1923. *О возрастных изменениях наклона таза.* „Русский антропологический журнал“, т. XII, вып. 3—4.

Бунак, В. В. 1923. *О гребнях на черепах приматов.* „Русский антропологический журнал“, т. XII, вып. 3—4.

Бунак, В. В. 1936. *Макроструктура головного мозга в период роста.* (Сборник работ Гос. н.—и. ин-та охраны эдоровья детей и подростков НКЗ РСФСР.) *Анатомические и гистоструктурные особенности детского возраста.* М., Биомедгих.

Бунак, В. В. 1940. *Размеры и форма позвоночника и их изменения в период роста.* „Ученые записки Московского государственного университета“, вып. 34 (Антропология), М., изд-во МГУ.

Бунак, В. В. 1941. *Антропометрия.* Практический курс. М.

Бунак, В. В. 1941. *Мерология. Соматология.* В книге *Антропология.* Краткий курс. В. В. Бунак. М. Ф. Нестурх, Я. Я. Рогинский, М., Учпедгиз.

Бунак, В. В. 1951. *Муляж мозговой полости палеолитического детского черепа из грота Тешик-Таш, Узбекистан.* „Сборник Музея антропологии и этнографии“, т. XIII, Л.

Бунак, В. В. 1951. *Происхождение речи по данным антропологии.* В сборнике *„Происхождение человека и древнее расселение человечества“*, М., Изд-во АН СССР.

Бунак, В. В. 1953. *Внутренняя полость черепа. Вариации ее строения и сопоставление с вариациями наружной формы.* „Сборник Музея антропологии и этнографии“, т. XV, Л.

Бунак, В. В. 1954. *Современное состояние проблемы эволюции стопы у предков человека.* В книге: Г. А. Бонч-Осмоловский. *Скелет стопы и голени ископаемого человека из грота Киик-Коба.* „Палеолит Крыма“, вып. 3, ред. и дополн. В. В. Бунака, М.—Л., Изд-во АН СССР.

Бунак, В. В. 1956. *Человеческие расы и пути их образования.* „Советская этнография“, № 1.

Бурчак-Абрамович, Н. О. и Габашвили, Е. Г. 1945. *Высшая человекообразная обезьяна из верхнетретичных отложений восточной Грузии.* „Сообщения Академии наук Грузинской ССР“, т. VI, № 6.

Бурчак-Абрамович, Н. О. и Габашвили, Е. Г. 1946. *Высшая человекообразная из верхнетретичных отложений восточной Грузии (Кахетии).* „Вестник государственного музея Грузии“, т. XIII, А.

Вацуро, Э. Г. 1948. *Исследование высшей нервной деятельности антропоида* (шимпанзе). М., Изд-во Акад. мед. наук СССР.

Вацуро, Э. Г. 1955. *Учение И. П. Павлова о высшей нервной деятельности.* М., Учпедгиз.

Вебер, М. 1936. *Приматы.* Перевод с немецкого, редакция и дополнения М. Ф. Нестурх. М.—Л., Биомедгиз.

Вейденрейх, Франц. 1937. *Новое открытие трех черепов пекинского синантропа* (перевод с английского) „Антропологический журнал", № 2.

Вейнерт, Ганс. 1933. *Новые находки первобытного человека на Яве.* Перевод с немецкого Р. Гальперина. „Успехи современной биологии", т. 2, № 1—2.

Вейнерт, Ганс. 1935. *Происхождение человечества.* Перевод с немецкого М. Е. Опочининой, под ред. М. А. Гремяцкого, М., Биомедгиз.

Воеводский, М. В. 1950. *Мезолитические культуры Восточной Европы.* „Краткие сообщения Института истории материальной культуры АН СССР", вып. XXXI, М.

Воеводский, М. В. 1953. *Ранний палеолит Русской равнины.* „Ученые записки Московского государственного университета", вып. 168 (*Ископаемый человек и его культура на территории СССР*). М.

Войно, М. С. 1958. *Сравнение формы мозга человека и обезьян по измерительным данным и обводам.* „Советская антропология", т. II, № 4.

Войтонис, Н. Ю. 1948. *Поведение обезьян и зарождение трудовой деятельности человека.* „Природа", № 6. Изд-во АН СССР.

Войтонис, Н. Ю. 1949. *Предистория интеллекта* (к проблеме антропогенеза). Ответственный редактор—д-р биологических наук Н. Н. Ладыгина-Котс. М.—Л., Изд-во АН СССР.

Воккен, Г. Г. 1940. *Скелет кисти резуса и некоторые возрастные изменения его.* „Вестник рентгенологии и радиологии", т. 22.

Воккен, Г. Г. 1949. *Закономерности дифференцировки костного скелета млекопитающих* (автореферат докторской диссертации). Л., изд. Центр. рентгенолог., радиолог. и раков. ин-та Мин-ва здравоохран. СССР.

Волоцкой, М. В. 1924. *О двух формах человеческой кисти преимущественно в связи с половыми, возрастными и расовыми различиями.* „Русский антропологический журнал", т. 13, вып. 3—4.

Воронин, Л. Г. 1952. *Анализ и синтез сложных раздражителей у высших животных,* Л., Медгиз.

Воронин, Л. Г. Канфор, И. С., Лакин, Г. Ф. и Тих, Н. А. 1948. *Опыт содержания и разведения обезьян в Сухуми.* М., Изд-во Акад. мед. наук СССР.

Вяткина, К. В. 1936. *О животном и растительном окружении наиболее первобытного человека.* В сборнике „Вопросы истории доклассового общества". М.—Л., Изд-во АН СССР.

Геккель, Эрнст. 1935. *Мировые загадки.* С прил. работы: Э. Геккель. *Монизм и законы природы.* Под редакцией А. А. Максимова. М., ГАИЗ.

Гексли, Томас. 1864. *О положении человека в ряду органических существ.* Перевод с английского под редакцией проф. А. Бекетова, СПб.

Герасимов, М. М. 1955. *Восстановление лица по черепу* (*современный и ископаемый человек*). М., Изд-во АН СССР.

Гиндце, Б. К. и Федотова, А. М. 1932. *Артерии головного мозга собачьего павиана* (Cynocephalus hamadryas). „Антропологический журнал", № 1.

Гладкова, Т. Д. 1958. *Сравнительная характеристика кожного рельефа ладоней человека и некоторых обезьян.* „Советская антропология", т. II, № 4.

Горький, М. 1941. *О языке.* В хрестоматии „*Современная литература*", сост. А. Дубовников и Е. Северин. М., Учпедгиз.

Грегори, В. К. 1936. *Эволюция лица от рыбы до человека.* Перевод с английского, под ред. Н. А. Бобринского. М.—Л., Биомедгиз.

Гремяцкий, М. А. 1922. *К вопросу об эволюции нижней челюсти у гоминид.* (Обзор новейшей литературы.) „Русский антропологический журнал", т. 12, кн. 1—2.

Гремяцкий, М. А. 1922. *Подкумская черепная крышка и ее морфологические особенности.* „Русский антропологический журнал", кн. 1—2.

Гремяцкий, М. А. 1932. *Из новейшей иностранной литературы по антропогенезу*. „Антропологический журнал", № 1 (стр. 124—129); № 2 (стр. 182—191); 1937, № 3 (стр. 136—137).

Гремяцкий, М. А. 1932. *Теория ологенеза в биологии и антропологии*. „Антропологический журнал", № 3.

Гремяцкий, М. А. 1934. *Ологенизм Монтандона*. „Антропологический журнал", № 1—2.

Гремяцкий, М. А. 1934. *Проблема антропогенеза*. „Антропологический журнал", № 3.

Гремяцкий, М. А. 1936. *Новое об ископаемых представителях гоминид*. „Антропологический журнал", № 1.

Гремяцкий, М. А. 1936. *Население Чжоу-Коу-Тьен*. „Антропологический журнал", № 2.

Гремяцкий, М. А. 1939. *Новости антропологической литературы. Проблема антропогенеза*. „Естествознание и марксизм", № 1.

Гремяцкий, М. А. 1941. *Некоторые морфологические черты суставов плечевого пояса гиббона*. „Краткие сообщения о научных работах научно-исследовательского института и Музея антропологии при Московском университете за 1938—1939 *гг*.

Гремяцкий, М. А. 1948. *Проблема промежуточных и переходных форм от неандертальского типа человека к современному*. „Ученые записки Московского государственного университета", вып. 115 (Труды Музея антропологии).

Гремяцкий, М. А. 1949. *Череп ребенка неандертальца из грота Тешик-Таш, Южный Узбекистан*. В книге „*Тешик-Таш*" („Труды научно-исследовательского института антропологии МГУ").

Гремяцкий, М. А. 1952. *К вопросу о филогенетических связях древнейших гоминид*. „Краткие сообщения института этнографии АН СССР", т. XV, стр. 62—71.

Гремяцкий, М. А. 1954. *Разгадка одной антропологической тайны*. „Советская этнография", № 1.

Гремяцкий, М. А. 1955. *Как произошел человек*. М., Изд-во МГУ.

Гремяцкий, М. А. 1955. *Филогенетическое единство приматов*. „Вестник Московского университета", (юбил. выпуск), № 4—5.

Гремяцкий, М. А. 1957. *Ископаемые обезьяны на территории Советского Союза*. „Советская антропология", т. 1, № 1.

Гремяцкий, М. А. 1957. *О „новом" роде человекообразных обезьян, названном „бонобо"*. „Советская антропология", т. 1, № 2.

Громов, В. И. 1948. *Палеонтологическое и археологическое обоснование стратиграфии континентальных отложений четвертичного периода СССР*. „Труды института геологических наук", вып. 17, М., Изд-во АН СССР.

Гуделис, В. И. и Повилонис, С. 1952. *Череп ископаемого человека*. „Природа", № 6.

Гурев, Г. А. 1941. *Атеизм Чарлза Дарвина*. М.—Л., Изд-во АН СССР.

Давиташвили, Л. Ш. 1948. *Эволюционная идея в палеонтологии после Дарвина*. М.—Л., Изд-во АН СССР.

Дарвин, Чарлз. 1953. *Происхождение человека и половой отбор. Выражение — эмоций у человека и животных*. Соч., т. 5, под редакцией акад. Е. Н. Павловского. М., Изд-во АН СССР.

Дарвин, Чарлз. 1957. *Воспоминания о развитии моего ума и характера (автобиография). Дневник работы и жизни*. Полный перевод с рукописей Ч. Дарвина, вступительная статья и комментарии проф. С. Л. Соболя, М., Изд-во АН СССР.

Дебец, Г. Ф. 1934. *Новая находка неандертальского человека*. „Антропологический журнал", № 1—2.

Дебец, Г. Ф. 1940. *Об антропологических особенностях человеческого скелета из пещеры Тешик-Таш*. (предварит. сообщ.). „Труды Узбекистанского филиала АН СССР", сер. 1 (История, Археология), вып. 1, Ташкент.

Дебец, Г. Ф. 1948. *О систематике и номенклатуре ископаемых форм человека.* „Краткие сообщения Института истории материальной культуры АН СССР“, вып. XXII, М.

Дебец, Г. Ф. 1948. *Палеоантропология СССР.* „Труды института этнографии АН СССР“. Нов. сер., т. IV, М.—Л., Изд-во АН СССР.

Дебец, Г. Ф. 1952. *Территория СССР и проблема родины человека.* „Краткие сообщения института этнографии им. Н. Н. Миклухо-Маклая АН СССР“. М., Изд-во АН СССР.

Дебец, Г. Ф. 1955. *Палеоантропологические находки в Костенках* (предварительное сообщение). „Советская этнография“, № 1.

Дебец, Г. Ф. 1955. *Расы человека.* БСЭ, т. 36.

Дебец, Г. Ф. 1956. *О принципах классификации человеческих рас.* „Советская этнография“, № 4.

Денисов, П. К. 1958. *Анализаторная и синтетическая функции больших полушарий шимпанзе.* „Журнал высшей нервной деятельности“, т. VIII, в. 6.

Дешин, А. А. 1922. *К вопросу и древнем образе жизни отдаленных предков человека* (реферат книги Вуда Джонса) „Русский антрополоческий журнал“, т. 12, кн. 1—2.

Дешин, А. А. 1934. *К вопросу об эволюиии коры мозга: развитие центральной области коры (островок Рейля) и ее покрышек у человека, приматов и хищных.* „Антропологический журнал“, № 1—2.

Елигулашвили, И. С. 1955. *Беременность и роды у обезьян.* Анатомо-физиологическое исследование. М.—Л., Медгиз.

Ефименко, П. П. 1953. *Первобытное общество.* Очерки по истории палеолитического времени, изд. 3, перераб. и доп. Киев, Изд-во АН УССР.

Жиров, Е. В. 1940. *Костяки из грота Мурзак-Коба.* „Советская археология“, № 5.

Иваницкий, М. Ф. 1956—1957. *Анатомия человека.* 3 издание, переработанное, тт. 1—2. М., „Физкультура и спорт“.

Каверзнев, А. А. 1951. *О перерождении животных.* Новый перевод с немецкого Б. Е. Райкова и С. Л. Соболя, в книге: „*Научное наследство*“, т. 2, М., Изд-во АН СССР.

Карлов, Н. Н. 1949. *Обоснование стратиграфии континентальных отложений четвертичного периода.* „Природа“, № 10.

Кёлер, Вольфганг. 1930. *Исследование интеллекта человекоподобных обезьян.* Перевод с немецкого Л. В. Занкова и И. М. Соловьева под ред. и с вступ. статьей Л. С. Выготского, М., Изд-во Коммунистической Академии.

Клосовский, Б. Н. 1954. *Развитие мозга ребенка.* М., Изд-во „Знание“.

Ковешникова, А. К. 1928. *Изменение формы лопатки животных в связи с переходом от горизонтального положения на четырех к вертикальному положению на двух конечностях.* „Известия Ин-та им. П. Ф. Лесгафта“, т. XIV., вып. 1 и 2.

Кононова, Е. П. 1949 *Лобная область.* В книге: „*Цитоархитектоника коры большого мозга человека*“. М., Медгиз.

Куксова, М. И. 1956. *Сезонные и суточные колебания красной крови у обезьян.* В сборнике: „*Теоретические и практические вопросы медицины и биологии в эксперименте на обезьянах*“, под редакцией И. А. Уткина, М., Медгиз.

Куксова, М. И. 1958. *Онтогенетическое развитие картины крови у макаков, резусов и павианов гамадрилов.* „Советская антропология“, т. II, № 2.

Куксова, М. И. 1958. *Прорезывание молочных зубов у павианов гамадрилов.* „Советская антропология“, т. II, № 1.

Куксова, М. И. 1959. *Сезонные и суточные колебания белой крови у низших обезьян.* „Журнал общей биологии“, т. XX, № 1, январь-февраль.

Кювье, Жорж. 1937. *Рассуждение о переворотах на поверхности земного шара.* Перевод с французского Д. Е. Жуковского. Редакция и вступительная статья акад. А. А. Борисяка. М.—Л., Биомедгиз.

Ладыгина-Котс, Н. Н. 1920. *Приспособительные моторные навыки макака в условиях эксперимента* (к вопросу о трудовых процессах низших обезьян). М., изд. Государственного Дарвиновского Музея.

Ладыгина-Котс, Н. Н. 1923. *Исследование познавательных способностей шимпанзе.* М., Госиздат.

Ладыгина-Котс, Н. Н. 1924. *О познавательных способностях шимпанзе.* Статья в книге: А. Брэм. *Человекообразные обезьяны.* М.-Л., изд-во „Земля и Фабрика".

Ладыгина-Котс, Н. Н. 1935. *Дитя шимпанзе и дитя человека в их инстинктах, эмоциях, играх, привычках и выразительных движениях.* „Труды Государственного Дарвиновского Музея", т. 3 (юбилейное изд.), М., изд. Государственного Дарвиновского Музея.

Ладыгина-Котс, Н. Н. 1956. *Развитие форм отражения в процессе эволюции организмов.* „Вопросы философии", № 4.

Лазарев, П. П. 1929. *Успехи геофизики.* М.—Л., ГИЗ.

Лазуков, Г. И. 1954. *Основные этапы развития флоры, фауны и человека в четвертичном периоде.* Под редакцией д-ра геогр. наук В. П. Гричука. М., изд-во МГУ.

Лакин, Г. Ф. 1958. *Изменение пропорций тела в онтогенезе низших обезьян.* „Советская антропология", т. II, № 2.

Лакин, Г. Ф. 1959. *Продолжительность беременности у павианов гамадрилов и некоторых других низших обезьян.* „Советская антропология", т. III, № 1.

Левин, М. Г. 1949. *Н. Г. Чернышевский о расах и расовой проблеме.* „Советская этнография", № 4.

Левин, М. Г. и Алексеева, Л. В. 1959. *Атланто-лопаточные мышцы у приматов.* „Советская антропология", т. III, № 1.

Левин, М. Г., Борисковский, П. И. и Якимов, В. П. 1950. *Доклады, посвященные проблеме происхождения типа современного человека.* „Краткие сообщения Института этнографии им. Н. Н. Миклухо-Маклая АН СССР", № IX, М.—Л,. Изд-во АН СССР.

Линней, К., 1804. *Система природы. Царство животных.* Ч. 1. СПб, издал с прим. и доп. Ал. Савостьянов.

Лукреций (Тит Кар). 1946. *О природе вещей.* Редакция латинского текста и перевод Ф. А. Петровского, т. 1, Л., Изд-во АН СССР (*О происхождении и развитии рода людского*—см. в книге пятой, стр. 283—365); 1947. *Статьи, комментарии, фрагменты Эпикура и Эмпедокла.* Сост. Ф. А. Петровский, т. 2, Л., Изд-во АН СССР.

Малис, Г. Ю. 1952. *Сухумская медико-биологическая станция Академии медицинских наук СССР.* М., Изд-во Акад. мед. наук СССР.

Миклухо-Маклай, Н. Н. 1950—1954. *Собрание сочинений.* М.—Л., Изд-во АН СССР, тт. I—V.

Миллер, Геррит. 1925. *Борьба мнений по вопросу о предках человека.* Перевод с английского, статья в книге: *Эволюция человека*, под ред. М. А. Гремяцкого. М., изд. Коммунистического университета им. Я. М. Свердлова (см. стр. 66—102).

Минаков, П. А. 1923. *О черепе питекантропа прямоходящего в связи с вопросом о посмертных изменениях кости* (предв. сообщ.) „Русский антропологический журнал", т. 13, вып. 1—2. См. критич. оценку данной работы в „Антропологическом журнале", № 1, 1932, стр. 152—153 (некролог).

Мюллер, Ф. и Геккель, Э. 1949. *Основной биогенетический закон.* Избранные работы. Со вступ. статьей И. И. Ежикова. М.-Л., Изд-во АН СССР.

Народы Африки. 1955. Под редакцией Д. А. Ольдерогге, И. И. Потехина. М., Изд-во АН СССР.

Нестурх, М. Ф. 1932. *Новые находки ископаемого человека:* 1. *Пекинский обезьяночеловек.* 2. *Неандерталец острова Явы* (*яванский человек*). 3. *Палестинский человек.* 4. *Олдовайский человек.* „Антропологический журнал", № 2.

Нестурх, М. Ф. 1932. „*Открытие*" *человекообразных обезьян на Суматре и*

в южной Америке. 1. *Орган-пендек.* 2. *Мерантропоид.* „Антропологический журнал", № 2.

Нестурх, М. Ф. *Человек и его предки.* М., ГАИЗ, 1934.

Нестурх, М. Ф. 1937. *Против идеализма на фронте антропогенеза (Новейшие буржуазные гипотезы антропогенеза в свете трудовой теории антропогенеза Энгельса и последние открытия ископаемых представителей гоминид).* „Фронт науки и техники", № 5, М., изд. ВАРНИТСО.

Нестурх, М. Ф. 1938. *Ископаемые антропоиды и древнейшие гоминиды* (по новейшим данным). „Успехи современной биологии", т. IX, вып. 2.

Нестурх, М. Ф. 1940. *Гипотеза антропогенеза Осборна и ее критика.* „Успехи современной биологии", т. 13, вып. 25, М.

Нестурх, М. Ф. 1941. *Антропогенез.* (Часть 1 в книге: В. В. Бунак, М. Ф. Нестурх, Я. Я. Рогинский. *Антропология.* Краткий курс.) М., Учепедгиз.

Нестурх, М. Ф. 1948. *Обезьянолюди и их отношение к прочим ископаемым гоминидам.* „Ученые записки Московского государственного университета, вып. 115 („Труды Музея антропологии"), М., Изд-во МГУ.

Нестурх, М. Ф. 1949. *Обезьяны.* В книге: „Московский зоопарк", М., Изд-во „Московский Рабочий" (см. стр. 333—392).

Нестурх, М. Ф. 1950. *Антропология.* БСЭ, т. 2, М., ОГИЗ.

Нестурх, М. Ф. 1950. *Предки человека.* М., Госкультпросветиздат.

Нестурх, М. Ф. 1954. *Ископаемые гигантские антропоиды Азии и ортогенетическая гипотеза антропогенеза Вейденрейха.* „Ученые записки Московского государственного университета", вып. 166. („Труды научно-исследовательского института антропологии). М., Изд-во МГУ, стр. 29—46.

Нестурх, М. Ф. 1954. *Человеческие расы.* Под редакцией Н. Н. Чебоксарова. М., Учпедгиз.

Нестурх, М. Ф., 1957. *Звенья родословной человека.* „Природа", № 1.

Нестурх, М. Ф. 1957. *Типы локомоции у обезьян и прямохождение у человека в связи с антропогенезом.* „Советская антропология", т. 1, № 2.

Никольский, В. К. 1937. *Дарвин и антропогенез* (к пятидесятилетию со дня смерти Ч. Дарвина). „Антропологический журнал", № 1.

Ожигова, А. П. 1958. *Цито- и миэлоархитектоника затылочной области коры больших полушарий у представителей разных экологических групп низших обезьян".* „Советская антропология", т. II, № 4.

Окладников, А. П. 1940. *Исследование палеолитической пещеры Тешик-Таш.* „Труды Узбекского филиала Академии наук СССР". Серия 1 (*История, Археология*), вып. 1, Ташкент.

Окладников, А. П. 1949. *Исследование мустьерской стоянки и погребения неандертальца в гроте Тешик-Таш, Южный Узбекистан.* В книге: *Тешик-Таш.*

Окладников, А. П. и Борисковский, П. И. 1956. *О времени и условиях становления человеческого общества.* „Вопросы истории", № 11.

Осборн, Генри Ферфильд. 1924. *Человек древнего каменного века (среда, жизнь, искусство).* Перевод с английского Б. Н. Вишневского и с прилож. его статьи „Доисторический человек в России". Л., „Путь к знанию".

Павловские среды. 1949. Тт. 1—3. М.-Л., Изд-во АН СССР.

Павлов, И. П. 1951—1954. *Полное собрание сочинений,* издание 2, тт. 1—6, М. Изд-во АН СССР.

Петров, Г. И. 1939. *Несостоятельная попытка антидарвинистического толкования сванскомбской находки.* „Природа", № 3.

Петров, Г. И. 1940. *Находка остатков неандертальского человека на горе Чирчео (Италия).* „Краткие сообщения института истории материальной культуры", VII.

Петров, Г. И. 1941. *Древнейшие остатки человека в Африке.* „Наука и жизнь", № 1.

Петров, Г. И. 1941. *Палестинские неандертальцы.* „Наука и жизнъ", № 4.

Писарев, Д. И. 1944. *Избранные философские и общественно-политические статьи,* М., Госполитиздат.

Плисецкий, М. С. 1949. *Об антропологических взглядах А. Н. Радищева.* „Советская этнография“, № 2.

Плисецкий, М. С. 1952. *О так называемых неандертальских погребениях.* „Советская этнография“, № 2.

Плисецкий, М. С. 1955. *Расизм.* БСЭ, т. 36.

Плисецкий, М. С. 1956. *Человек и его расы.* М., Госкультпросветиздат.

Полетика, Н. 1936. *„Обезьяний процесс“ в Америке.* М.-Л., Госиздат.

Поляков, Г. И. 1949. *Структурная организация коры большого мозга человека по данным развития ее в онтогенезе.* В книге: *Цитоархитектоника коры большого мозга человека*“.

Поляков, Г. И. 1956. *О соотношениях основных типов нейронов в коре мозга человека.* „Журнал высшей нервной деятельности“, т. V, вып. 3.

Поляков, Г. И. 1958. *О некоторых особенностях усложнения нейронного строения коры мозга человека, обезьян и других млекопитающих.* „Советская антропология“, т. II, № 4.

Поляков, Г. И. 1958. *О некоторых особенностях усложнения строения нейронов центральной нервной системы у человека, приматов и других млекопитающих.* „Советская антропология“, т. II, № 3.

Попова-Латкина, Н. В. 1957. *К вопросу о развитии грудной клетки человека и некоторых млекопитающих.* Второе совещание эмбриологов СССР 28 января — 5 февраля 1957 г. (Тезисы докладов). М., Изд-во МГУ.

Поршнев, Б. Ф. 1955. *Материализм и идеализм в вопросах становления человека.* „Вопросы философии“, № 5.

Поршнев, Б. Ф. 1955. *О древнейшем способе получения огня.* „Советская этнография“, № 1.

Преображенская, Н. С. и Филимонов, И. Н. 1949. *Затылочная область.* В книге: „*Цитоархитектоника коры большого мозга человека*, М., Медгиз, стр. 240—262.

Происхождение человека и древнее расселение человечества. 1951. „Труды Ин-та этнографии им. Н. Н. Миклухо-Маклая“. Нов. сер., т. XVI, под ред. М. Г. Левина (отв. ред.), Г. Ф. Дебеца и Я. Я. Рогинского, М., Изд-во АН СССР.

Радищев, А. Н. *Избранные философские сочинения* под общ. ред. и с пред. А. И. Липатова. М., Госполитиздат, стр. 271—398.

Райков, Б. Е. 1954—1955. *Русские биологи-эволюционисты до Дарвина* (Материалы к истории эволюционной идеи в России). Тт. 1—3, М.—Л., Изд-во АН СССР.

Рогинская, А. Ю. 1950. *Зараут-Сай* (записки художника). М., Детиздат.

Рогинский, Г. З. 1940. *О соотношении различных рецепторов в поведении обезьян. Исследования по проблеме чувствительности* („Труды Государственного института по изучению мозга им. В. И. Бехтерева“, т. XIII). Л.

Рогинский, Г. З. 1948. *Навыки и зачатки интеллектуальных действий у антропоидов* (шимпанзе). Л., Изд-во Ленинградского университета.

Рогинский, Г. З. 1953. *К вопросу о парной работе больших полушарий головного мозга у низших обезьян.* Ученые записки Ленинградского педогогического ин-та им. А. И. Герцена“, т. 38, стр. 129—145.

Рогинский, Г. З. 1955. *Высшая нервная деятельность человекообразных обезьян.* Об опытах акад. И. П. Павлова. „Природа“, № 2, М., Изд-во АН СССР.

Рогинский, Я. Я. 1933. *Помолодение в процессе человеческой эволюции* (изложение и критика теории Л. Болька). „Антропологический журнал“, М., № 3.

Рогинский, Я. Я. 1934. *Филогенез и вариации черепа человека.* БСЭ, т. 61, стр. 230—234.

Рогинский, Я. Я. 1936. *К вопросу о периодизации процесса человеческой эволюции.* „Антропологический журнал“, № 4.

Рогинский, Я. Я. 1937. *Новые находки синантропа.* „Антропологический журнал“, № 1.

Рогинский, Я. Я. 1938. *Проблема происхождения Homo sapiens* (по данным работ последнего двадцатилетия). „Успехи современной биологии“, т. IX, вып. 1, М

Рогинский, Я. Я. 1946. *Н. Н. Миклухо-Маклай.* „Советская этнография", М., № 2.

Рогинский, Я. Я. 1948. *Новые теории происхождения человека.* М., Изд-во „Правда".

Рогинский, Я. Я. 1948. *Что такое человеческие расы.* М., Изд-во „Правда".

Рогинский, Я. Я. 1949. *Теория моноцентризма и полицентризма в проблеме происхождения современного человека и его рас* („Труды Музея антропологии") М., Изд-во МГУ.

Рогинский, Я. Я. 1951. *Основные антропологические вопросы в проблеме происхождения современного человека.* В сборнике: Происхождение человека и древнее расселение человечества. М., Изд-во АН СССР.

Рогинский, Я. Я. 1956. *Некоторые проблемы происхождения человека.* „Советская этнография", № 4.

Рогинский, Я. Я., Левин, М. Г. 1955. *Основы антропологии.* М., изд-во МГУ.

Рокотова, Н. А. 1953. *Условные исследовательские рефлексы у шимпанзе.* „Труды ин-та физиологии им. И. П. Павлова", т. 2 (Вопросы физиологии высшей нервной деятельности), М.-Л., Изд-во Академии медицинских наук СССР.

Северцов, А. Н. 1939. *Морфологические закономерности эволюции* (Теория филэмбриогенеза, стр. 453—591). М.-Л., Изд-во АН СССР.

Семенов, С. А. 1951. *О сложении защитного аппарата глаз монгольского расового типа.* „Советская этнография", № 4, М.

Семенов, С. А. 1954. *Влияние природных условий на строение защитного аппарата глаз у человека.* „Природа", № 12.

Семенова, И. А. 1937. *Размеры и форма стопы плода и младенца.* Ученые записки Московского государственного университета, вып. 10, *Антропология.* М.-Л., ОНТИ НКТП СССР.

Синельников, Н. А. 1934. *О новых находках бедер питекантропа.* „Антропологический журнал", № 1—2.

Синельников, Н. А. 1937. *О пространственном расположении остеонов в диафизе бедра человека и других приматов.* „Антропологический журнал", № 3.

Синельников, Н. А. и Гремяцкий, М. А. 1949. *Кости скелета ребёнка неандертальца из грота Тешик-Таш, Южный Узбекистан.* В книге: *Тешик-Таш,* стр. 123—136.

Слоним, А. Д. 1952. *Животная теплота и ее регуляция в организме млекопитающих.* М.-Л., Изд-во АН СССР.

Соболь, С. Л. 1940. *Первое июля 1858 г. — двадцать четвертое ноября 1859 г.* (Полемика вокруг идей Дарвина в период, предшествовавший выходу в свет „*Происхождения видов*"). „Журнал общей биологии", т. 1, № 1.

Сушкин, П. П. 1928. *Высокогорные области Азии и происхождение человека.* „Природа", № 3.

Теоретические и практические вопросы медицины и биологии в эксперименте на обезьянах. Сборник научных работ под редакцией кандидата биологических наук И. А. Уткина. М., Медгиз.

Тешик-Таш. Палеолитический человек. 1949. Под редакцией М. А. Гремяцкого и М. Ф. Нестурха. „Труды научно-исследовательского института антропологии МГУ", М., Изд-во МГУ.

Тимирязев, К. А. 1935. *Чарльз Дарвин и его учение.* М., ГАИЗ (см. стр. 139—141 и 188—189).

Тимирязев, К. А. 1938. Соч., т. V, М., Сельхозгиз, стр. 314.

Тимирязев, К. А. 1938. Соч., т. VII, Сельхозгиз, стр. 547.

Тих, Н. А. 1950. *Стадная жизнь обезьян и средства их общения в свете проблемы антропогенеза.* (Автореферат диссертации) Л., Изд. физиологического ин-та им. И. П. Павлова АН СССР.

Толстов, С. П. 1946. *К вопросу о периодизации первобытного общества.* „Советская этнография", № 1, М.

Труды Сухумской биологической станции Академии медицинских наук СССР. 1949. Под ред. д-ра биол. наук Л. Г. Воронина, т. 1, М., Изд-во Акад. мед. наук СССР.

Уоллес, Альфред Руссель. 1811. *Дарвинизм: изложение теории естественного подбора и некоторых из ее приложений.* Перевод с английского М. А. Мензбира, с прил. его статьи: *А. Уоллес и его научное значение*, изд. 2, доп. М., изд. М., М. и С. Сабашниковых.

Уоллес, Альфред Руссель. 1872. *Малайский архипелаг. Страна орангутана и райской птицы.* Пер. со 2-го англ. изд. СПб, изд. „Общественная польза".

Урысон, М. И. 1957. *Новейшие палеоантропологические открытия в Африке.* „Советская антропология", № 1.

Урысон, М. И. 1958. *Новые находки костных остатков гигантопитека в Китае.* „Советская антропология", т. II, № 2.

Урысон, М. И. 1959. *Метопизм у человека.* „Советская антропология", т. III. № 1.

Уткин, И. А. 1954. *Сухумская медико-биологическая станция Академии медицинских наук СССР и ее питомник обезьян.* М., Медгиз.

Уткин, И. А. и Куксова, М. И. 1956. *Изменение количества лейкоцитов при повторных исследованиях крови в одних и тех же условиях.* Доклады АН СССР, т. 108, № 5.

Фабри, К. Э. 1958. *Обращение с предметами у низших обезьян и проблема зарождения трудовой деятельности.* „Советская антропология", т. II, № 1.

Филимонов, И. Н. 1949. *Сравнительная анатомия архитектонических формаций коры большого мозга.* В книге: „*Цитоархитектоника коры большого мозга человека*", М., Медгиз.

Филимонов, И. Н. 1949. *Цитоархитектоника. Общие понятия. Классификация архитектонических формаций.* В книге: „*Цитоархитектоника коры большого мозга человека*", М., Медгиз.

Хрисанфова, Е. Н. 1956. *Особенности строения гортани человека и обезьян.* „Вестник Московского университета, № 1.

Хрисанфова, Е. Н. 1957. *Внутригрупповая и межгрупповая изменчивость основных размеров черепа узконосых обезьян и людей.* „Вестник Московского университета", № 2.

Хрисанфова, Е. Н. 1956. *Особенности строения гортани человека и обезьян.* „Вестник Московского университета", № 1.

Хрисанфова, Е. Н. 1957. *Вариации височных линий на черепе человека в сравнительно-анатомическом освещении.* „Советская антропология", т. 1, № 1.

Цитоархитектоника коры большого мозга человека. 1949. Под общ. ред. С. А. Саркисова, И. Н. Филимонова и Н. С. Преображенской. М., Медгиз.

Чебоксаров, Н. Н. 1951. *Основные принципы антропологических классификаций.* „Труды Института этнографии Академии наук СССР им. Миклухо-Маклая" (Нов. сер.), т. XVI. Происхождение человека и древнее расселение человечества. М., Изд-во АН СССР.

Чернышевский, Н. Г. 1948. *Антропологический принцип в философии.* М., Госполитиздат.

Чернышевский, Н. Г. 1951. *Избранные философские сочинения.* М., Госполитиздат (*О расах, — см.* стр. 557—579).

Шевченко, Ю. Г. 1956. *Индивидуальные и групповые вариации строения коры большого мозга* (*нижне-теменной области*) *современных людей.* „Вестник Академии медицинских наук СССР", № 5.

Шимкевич, В. М. 1912. *Курс сравнительной анатомии позвоночных животных.* СПб-М. (См. стр. 254—256).

Штефко, В. Г. и Харьков, А. А. 1946. *Эклампсия у обезьян.* „Труды Московского зоопарка", т. III.

Щелкунов, С. И. 1940. *Изменение стопы в условиях различной функциональной нагрузки.* „Архив анатомии, гистологии и эмбриологии", т. XXIV, № 1.

Экли, Карл, 1923. *В сердце Африки.* Перевод с английского, М., Госиздат (о гориллах — см. стр. 154—201).

Юзефович, А. Н. 1937. *Теория антропогенеза Г. Вейнерта.* „Природа", № 12.

Юзефович, А. Н. 1939. *Синантроп и его положение в системе гоминид.* „Природа", № 1.

Якимов, В. П. 1946. *Онтогенетическое формирование пропорций передних конечностей у человека и млекопитающих.* „Зоологический журнал", т. XXV, вып. 2, М.

Якимов, В. П. 1947. *Развитие скелета передних конечностей человека и некоторых млекопитающих.* „Зоологический журнал", т. XXVI, вып. 4.

Якимов, В. П. 1949. *О двух морфологических типах европейских неандертальцев.* „Природа", № 10.

Якимов, В. П. 1950. *Обзор новейших палеоантропологических открытий в Африке.* „Природа", № 10.

Якимов, В. П. 1951. *Ранние стадии антропогенеза.* В сборнике: *Происхождение человека и древнее расселение человечества.* М., Изд-во АН СССР, т. XVI.

Якимов, В. П. 1954. *Проблема соотношения ископаемых людей современного и неандертальского типа.* „Советская этнография", № 3.

Якимов, В. П. 1955. *Рецензия на работу Кенигсвальда о гигантопитеке.* „Советская этнография", № 1.

Якимов, В. П. 1956. *„Атлантроп" — новый представитель древнейших гоминид.* „Советская этнография", № 3.

Якимов, В. П. 1957. *Позднепалеолитический ребенок из погребения на Городцовской стоянке в Костенках.* „Сборник Музея антропологии и этнографии Академии наук", т. XXIII.

Abel, O. 1931. *Die Stellung des Menschen im Rahmen der Wirbeltiere*, Jena.

Abel, O. 1935. „Das Verwandschaftsverhältnis zwischen dem Menschen und den höheren fossilen Primaten", *Zschr. f. Morph. u. Anthrop.*, Bd. XXXIV (Festband Eugen Fischer).

Abel, W. „Zwillinge bei Mantelpavianen und Zwillingsanlage innerhalb der Primaten", *Zschr. f. Morph. u. Anthrop.*, Bd. XXXI, H. 2.

Abel, W. 1931. *Kritische Untersuchungen über Australopithecus africanus Dart, Morphologisches Jahrbuch*, Bd. 65, H. 4.

Abel, W. 1931. „Über Australopithecus und seine Stellung zu den Anthropoiden und Hominiden", *Verhandlungen der Zool.-Bot. Gesellschaft in Wien*, Bd. 80.

Aeby, C. 1867. *Die Schädelformen des Menschen und der Affen. Eine morphologische Studie*, Leipzig.

Akeley, Carl and Akeley, Mary. 1934. *Lions, Gorillas and Their Neighbours*, London.

Ameghino, Florentino. 1934. *Obras completas y correspondencia scientifica de Fl. Ameghino.* Edicion oficial ordenada por el gobierno de la provincia de Buenos Aires, dirigida por Alfredo J. Torcelli. En français et espagnol. La Plata. V. XVII. El Tetraprothomo y el Diprothomo, p. 707, ills. V. XVIII, Paleoanthropologia argentina.

Andrews, R. C. 1933. *On the Trail of Ancient Man*, The Amer. Mus. Nat. Hist., New York.

Andrews, R. C. 1946. *Meet Your Ancestors*, New York.

Anthony, J. 1946. "Morphologie externe du cerveau des singes platyrhiniens", *Ann. Sci. Nat.*, Zool., 11 Série, t. VIII.

Anthony, J. 1952. "L'évolution cérébrale des primates", *Biol. méd.*, *v.* 41, No. 5.

Anthony, R. 1928. *Anatomie comparée du cerveau.* Paris.

Arambourg, C. 1954. "L'hominien fossile de Ternifine (Algérie)" *C. R. Acad. Sci.*, V. 239, No. 15, Paris.

Arambourg, C. 1955. "Sur l'attitude, en station verticale, des Néanderthaliens", *C. R. Acad. Sci.*, V. 240, No. 7, Paris.

Ashton, E. H. and Zuckerman, S. 1950. "Some Quantitative Dental Characteristics of the Chimpanzee, Gorilla and Orang-outang," *Philos. Trans. Roy. Soc. of London* ser. B, No. 616, V. 234.

Babor, J. F. und Frankenberger, Z. 1931. „Über das fetale Wachstum der Gorilla," *Biologia generalis*, Bd. VII, Lief. 3.

Bavink, B. 1933. *Ergebnisse und Probleme der Naturwissenschaften* (Eine Einführung in die heutige Naturphilosophie). Fünfte Aufl. Leipzig („Ursprung des Menschen" S. 450–464).

Beattie, J. 1927. "The Anatomy of the Common Marmoset (Hapale jacchus)," *Proc. Zool. Soc. London*, Part III.

Benchley, B. J. 1944. *My Friends, the Apes*, London.

Bennejeant, Ch. 1936. *Les variations morphologiques dentaires humaines. Communication au IX^e Congrès Français de Stomatologie*, Paris, 1936, Séance du 6 Octobre.

Bingham, Harold C. 1932. *Gorillas in a Native Habitat.* Report of the joint expedition of 1929-1930 of Yale University and Carnegie Institution of Washington for psychobiological study of mountain gorillas (Gorilla beringei) in Parc national Albert, Belgian Congo, Africa. Carnegie Institution of Washington, publication No. 426. Published by Carnegie Institution of Washington (August).

Black, Davidson. 1934. "On the Discovery, Morphology and Environment of Sinanthropus pekinensis," *Philos. Trans. Roy. Soc. of London*, ser. B, V. 233.

Black, D., Teilhard de Chardin, Young, C. C., Pei, W. C. 1933. "Fossil Man in China. The Choukoutien Cave Deposits with a Synopsis of Our Present Knowledge of the Late Cenozoic in China." *Geological Memoirs*, ser. A., N. LI, p. 158. With a foreword by Wong Wen Hao. Peiping.

Blanc, A. C. 1940. "The Fossil Man of Circe's Mountain," *Natural History.*

Bluntschli, H. 1913. „Die fossilen Affen Patagoniens und der Ursprung der platyrhinen Affen", *Anat. Anzeiger*, Bd. 44, Ergänzungsheft.

Böker, Hans. 1935. *Einführung in die vergleichende biologische Anatomie der Wirbeltiere.* Bd. I, 1937. *Biologische Anatomie der Ernährung*, Bd. 2, Jena.

Bolk, Louis. 1925. „Vergleichende Untersuchungen an einer Fötus von Gorilla und von Schimpanse", *Zschr. f. Anat. u. Entw.-gesch.*, Bd. 81, H. 1–2.

Bolk, L. 1926. „Das Problem der Menschwerdung. Vortrag auf der XXV. Versammlung der Anatomischen Gesellschaft zu Freiburg," Jena.

Boule, Marcellin, Vallois, Henri V. 1952. *Les hommes fossiles. Eléments de paléontologie humaine*, 4 éd. Paris.

Boulenger, E. G. 1936. *Apes and Monkeys*, London.

Brodmann, K. 1925. *Vergleichende Lokalisationslehre der Großhirnrinde in ihren Prinzipien dargestellt auf Grund des Zellenbaues*, Leipzig.

Broom, R. and Shepers, G. 1946. "The South-African Fossil Ape-Men, the Australopithecinae." *Transvaal Museum Memoirs*, No. 2, Pretoria.

Buffon, Georges Louis Leclerc, Comte de. 1799-1808. "Histoire naturelle des singes". In: *Histoire naturelle générale et particulière.* Nouvelle édition par Latreille. Paris. T. 35^e et 36^e.

Buxton Ductley, L. H. and de Beer, G. R. 1932. "Neanderthal and Modern Man," *Nature*, V. 129, No. 3269, June 25.

Carpenter, C. R. 1934. "A Field Study of the Behaviour and Social Relations of Howling Monkeys, *Comparative Psychological Monographs*, V. 10, No. 2 (ser. No. 48).

Carpenter, C. R. 1935. "Behaviour of Red Spider Monkeys in Panama. *Journal of Mammalogy*, V. 16. No. 3 (preliminary report).

Carpenter, C. R. 1937. "An Observational Study of the Captive Mountain Gorillas (Gorilla beringei)," *Human Biology*, May, V. 9, No. 2.

Carpenter, C. R. 1941. "A Field Study in Siam of the Behaviour and Social Relations of the Gibbon (Hylobates)," *Comp. Psych. Mon.*, XVI, No. 5 (ser. No. 84).

Carpenter, C. R. 1942. "Sexual Behaviour of the Free Ranging Rhesus Monkeys (Macaca mulatta)," *Journ. Comp. Psych.*, V. 33.

Catalogue des hommes fossiles. 1953. Sous la rédaction de Henry Vallois V. et Hallam L. Movius. *Comptes rendus de la neuvième session du Congrès Géologique International 1952*, Algér, Sect. 5, fasc. 5. Algér.

Chernyshevsky, N. G. "The Anthropological Principle in Philosophy," in *Selected Philosophical Essays*, Moscow 1953.

Clark, W. E. Le Gros. 1934. *Early Forerunners of Man: a Morphological Study of the Evolutionary Origin of the Primates*, London.

Clark, W. E. Le Gros. 1949. *History of the Primates: an Introduction to the Study of Fossil Man*, London.

Clark, W. E. Le Gros. 1953. "Growth and Body Proportions in Relation to the Systematics of the Higher Primates," *Proc. Linnaean Soc. London*, V. 164, Part 2.

Colbert, E. H. 1942. "The Pleistocene Faunas of Asia and Their Relationship to Early Man," *Trans. New York Academy of Sciences*, ser. 11, V. 5.

Colbert, Edwin H. "A New Primate from the Upper Eocene Pondaung Formation of Burma," *American Museum Novitates*, No. 951, October 1, 1937.

Collias, Nicholas and Southwick, Charles. 1952. "A Field Study of Population Density and Social Organization in Howling Monkeys. *Proc. Amer. Philos. Soc.*, Philadelphia, V. 96, No. 2.

Connolly, Cornelius J. 1950. *External Morphology of the Primate Brain*, Springfield, Ill.

Coolidge, H. J. 1929. "A Revision of the Genus Gorilla," *Memoirs of the Museum of Comparative Zoology, Harvard College*, Cambridge, U.S.A., V. L, No. 4.

Coolidge, H. J. 1933. "Pan paniscus. Pigmy Chimpanzee from South of the Congo River." *Amer. J. of Phys. Anthrop.*, V. XVIII, No. 2, July-September.

Cooper, C. F. and Watson, S. 1932. "The Oldoway Human Skeleton," *Nature*, February and June.

Crusafont, Pairo M., Comella, J. F. de Villalta 1954. "Almogaver," un nuevo primate del eoceno pirenaico. *Estudios geol.*, V. 10, No. 22.

Davis, D. Dwight. "Primate Evolution from the Viewpoint of Comparative Anatomy," *Human Biology*, 1954, V. 26. No. 3.

Dacqué, E. 1935. *Organische Morphologie und Palaeontologie*, Berlin.

Dart, R. A. 1925. "Australopithecus africanus: The Man-Ape of South Africa," *Nature*, V. 115 No. 2884 February 7, London.

Dart, R. A. 1948. "The Makapansgat Proto-Human, Australopithecus Prometheus," *American Journal of Physical Anthropology*, V. 6, No. 3, Sept.

Dart, R. 1949. "The Predatory Implemental Technique of Australopithecus," *American Journal of Physical Anthropology*, Vol. 7, No. 1.

Darwin, Charles. 1887. *Darwin Leben und Briefe, mit einem seine Autobiographie enthaltenden Capitel.* Übers. von J. V. Carus, Bd. I—III.

Dembowski, J. 1951. *Psychologia malp*, Wyd. 2. Warszawa.

Doornik, J. E. 1808. *Wijsgerig natuurkundig onderzock aan gaande de vorsprong-lijke mensch*, Holland.

Drennan, M. R. 1953. "The Saldanha Skull and Its Association," *Nature*, V. 172, No. 4383, October 31.

Dubois, E. 1894. *Pithecanthropus erectus, eine menschenähnliche Übergangsform aus Java*, Batavia.

Duckworth, W. L. H. 1915. *Morphology and Anthropology*, A handbook for students, Cambridge.

Edinger, Ludwig. 1911. *Vorlesungen über den Bau der nervösen Zentralorgane des Menschen und der Tiere*, Bd. I. *Das Zentralnervensystem des Menschen und der Säugetiere*. Leipzig.

Edinger, Tilly. 1929. „Die fossilen Gehirne", *Ergebnisse der Anatomie und Entwicklungsgeschichte*, Bd. 28. Berlin.

Ehrenberg, K. 1938. „Austriacopithecus, ein neuer menschenähnlicher Primate aus dem Myozän von Klein-Hagersdorf bei Poysdorf in Niederösterreich (Nieder-Donau)", *Sitzungsberichte der Mineralogie, Biologie, Erdkunde*, Bd. 147, H. 3/4.

Elder, J. H. 1934. "Auditory Acuity of the Chimpanzee," *Journal of Comparative Psychology*, V. XVII, No. 2, April.

Elder, J. H. 1935. "The Upper Limit of Hearing in Chimpanzee," *The Amer. Journ. of Physiol.*, V. 112, No. 1, May.

Elliot, Daniel Giraud. 1912. (1913). *A Review of the Primates*. Vols. I-III, New York.

Elliot Smith, G. 1931. "The Evolution of Man: Early Man, His Origin, Development and Culture," London.

Ericson, G. E. 1954. "Comparative Anatomy of New World Primates and Its Bearing on the Phylogeny of Anthropoid Apes and Man," *Human Biology*, V. 26, No. 3.

Es, L. J. C. van. 1931. *The Age of Pithecanthropus*, The Hague.

Ewing, H. E. 1935. "Sham Louse-Picking, or Grooming, Among Monkeys," *Journal of Mammalogy*, V. 16. No. 4.

Fick, R. 1933. *Untersuchungen an der Wirbelsäule der Menschenaffen*. „Sitzungsberichte der Preußischen Akademie der Wissenschaften", Phys.-math. Klasse, Bd. V; ib., 1936, Bd. XVII.

Fiedler, Walter. 1956. „Übersicht über das System der Primaten". In: *Primatologia*, Bd. I.

Flower, S. 1931. "Contributions to Our Knowledge of the Duration of Life in Vertebrate Animals. V. Mammals," *Proc. Zool. Soc.*, London.

Forbes, H. O. A. 1894. *A Handbook to the Primates*, Vol. 1-2, London.

Friedenthal, H. 1900. „Über einen experimentallen Nachweis von Blutverwandschaft", *Arch. f. Anat. u. Physiol.*, Physiol. Abt., H. 5, 6.

Garrod, D. A. E. and Bate, D. M. A. 1937. *The Stone Age of Mount Carmel*, Oxford, V. I. Excavations at Wady el-Mughara, Oxford.

Gavan, James A. 1935. "Growth and Development of the Chimpanzee: A Longitudinal and Comparative Study," *Human Biology*, V. 25, No. 2, May.

Grandidier, G. et Petit, G. 1932. *Zoologie de Madagascar*, Préface de M. E. Bourdelle, Paris.

Gray, A. P. 1954. *Mammalian Hybrids*. A check-list with bibliography. Edinburgh, Commonwealth Agricultural Bureau, V. X.

Gregory, W. K. 1916. *Evolution of the Primates*. I. The Cope-Osborn theory of triberculy and the ancestral molar patterns of the Primates. II. Philogeny of recent and extinct anthropoids with special reference to the origin of man. *Bull. Amer. Mus. Nat. Hist.*, V. 35, No. 19.

Gregory, W. K. 1922. *The Origin and Evolution of Human Dentition*, Baltimore.

Gregory, W. K. 1927. "Hesperopithecus Apparently Not an Ape Nor a Man," *Nature*, V. LXVI, No. 1720, December 16.

Gregory, W. K. 1934. *Man's Place Among the Anthropoids*. Three lectures on the evolution of man from the lower vertebrates, Oxford-London.

Gregory, W. K. 1951. *Evolution Emerging*. A survey of changing patterns from primeval life to man. V. I. and II, New York.

Gregory, W. K. and Hellman, M. 1938. "Evidence of the Australopithecinae Man-Apes on the Origin of Man," *Science*, V. 88, No. 3.

Gregory, W. K., Hellman, M. & Lewis, G. E. "Fossil Anthropoids of the Yale, Cambridge, India Expedition of 1935," Carnegie Institute Publications, Washington, No. 495, 1939.

Grether, W. F. 1940. "Chimpanzee Color Vision," *The Journal of Comparative Psychology*, V. 29, No. 2, August.

Grether, W. F. 1940. "Color Vision and Color Blindness in Monkeys," *Comparative Psychology Monographs*, V. 15, No. 4 (76), June.

Grosser, Otto. 1927. *Frühentwicklung, Eihautbildung und Placentation des Menschen und der Säugetiere*, München.

Haan, I. A. Bierens de. 1931. „Werkzeuggebrauch und Werkzeugherstellung bei einem niederen Affen (Cebus hypoleucus Humb.)", *Zeitschrift für die vergl. Physiol.*, Berlin, Bd. 13, H. 4.

Harms, J. W. 1956. „Fortpflanzungsbiologie". In: *Primatologia*, Bd. I.

Heberer Gerhard. 1946. „Die Fossilgeschichte der Hominoidea". In: *Primatologia*, Bd. I.

Hegner, F. M. Root, Augustine D. L. and Huff, C. C. 1938. *Parasitology*. With special reference to man and domestic animals.

Hertig, A. T., Rock, J., Adams, E. C., Milligan, J. W. 1954. "On the Preimplantation Stages of the Human Ova," *Contrib. Embryol. Carnegie Inst.*, V. 35.

Hill, W. C. Osman. 1953, 1955, 1957. *Primates. Comparative Anatomy and Taxonomy.* Vols. 1, 2, 3. Edinburgh.

Hooton, E. A. 1931. *Up from the Ape*, London.

Hooton, E. A. 1942. *Man's Poor Relations*, New York.

Howells, W. 1945. *Mankind So Far*, New York.

Hrdlička, A. 1927. "Neanderthal Phase of Man," *Journal of the Royal Anthropological Institution*, December.

Hrdlička, A. 1930. "The Skeletal Remains of Early Man." (*Smithsonian Miscellaneous Collections*, V. 83), Washington.

Hrdlička, A. 1932. *Children Who Run on All Fours and Other Animal-Like Behaviours in the Human Child*, New York.

Huber, E. 1913. *Evolution of Facial Musculature and Facial Expression*, Baltimore-London.

Hubrecht, A. A. W. 1896. „Die Keimblase von Tarsius" (Ein Hilfsmittel zur schärferen Definition gewisser Säugetierordnungen), *Zeitschrift Gegenbaur*'s, Leipzig, Bd. 2.

Hürzeler, Johannes. 1954. „Zur systematischen Stellung von Oreopithecus", *Verhand. Naturforsch. Gesellschaft Basel*, Bd. 65, No. 1.

Janson, H. W. 1952. *Apes*, London.

Jobert, M. 1873. Recherches sur la queue prenante d'un singe (Atelle). *C. R. de la Soc. de Biol.* V sér. t. 3. 25. nov.

Jones, F. W. 1929. *Man's Place Among the Mammals.*

Jones, F. W. 1944. *Principles of Anatomy as Seen in the Hand*, London.

Jones, F. W. 1946. *Structure and Function as Seen in the Foot*, London.

Jones, F. W. 1948. *Hallmarks of Mankind*, Baltimore.

Kälin, J. 1945. Zur Systematik und Nomenklatur der fossilen Hominiden. *Bull. d. Schweiz. Gesellsch. f. Anthropologie u. Ethnologie*, 1944-1945.

Kälin, J. 1955. „Zur Systematik und evolutiven Deutung der höheren Primaten", *Experentia*, Bd. II, No. 1.

Keith, A. 1926. "The Gorilla and Man as Contrasted Forms," *The Lancet*, March 6.

Keith, A. 1929. *The Antiquity of Man*, Vols. 1-2, London.

Keith, A. 1931. *New Discoveries Relating to the Antiquity of Man.*

Keith, A. 1933. *Human Embryology and Morphology*, London.

Keith, A. 1934. "The Construction of Man's Family Tree." (*The Forum Ser.*, No. 18). London.

Kleinschmidt, O. 1931. *Der Urmensch*, Leipzig.

Klüver, H. 1933. *Behaviour Mechanisms in Monkeys* (Behaviour Research Fund Monographs), Chicago.

Kobler, R. 1932. *Der Weg des Menschen vom Links- zum Rechtshänder: ein Beitrag zur Vor- und Kulturgeschichte des Menschen*, Wien und Leipzig.

Koch, Franz. 1929. *Ursprung und Verbreitung des Menschengeschlechts. Eine Neubegründung des Darwinismus auf Grund der Polarwanderungen und Anschluß an die Theorie Wegeners*, Jena.

Koch, Walter und Deimel, Benno. 1952. *Über Krankheiten der Menschenaffen* („Veröffentlichungen aus der morphologischen Pathologie", Heft 57) Jena.

Koenigswald, G. H. R. von. 1955. *Begegnungen mit dem Vormenschen*, Düsseldorf-Köln.

Kohlbrügge, J. H. F. 1891. „Versuch einer Anatomie des Genus Hylobates." In: Max Weber, *Zoologische Ergebnisse einer Reise in Niederländische Ostindien*, Bd. 1, Leiden.

Kohlbrügge, J. H. F. 1908. *Die morphologische Abstammung des Menschen*, Stuttgart.

Kollmann, J. 1906. „Der Schädel von Kleimkems und die Neanderthal-Spy-Gruppe", *Archiv für Anthropologie*, Bd. V, H. 3.
Kolmer, W. 1930. „Über die Augen der Primaten". *Klinische Monographien für Anatomie*, Bd. 85.
Kolmer, W. 1930. „Zur Kenntnis der Augen der Primaten", *Zeitschrift für Anatomie und Entwicklungsgeschichte*, Bd. 103.
Kummer, Benno. 1953. „Untersuchungen über die Entwicklung der Schädelform des Menschen und einiger Anthropoiden." (*Abhandlungen zur Exakten-Biologie*, H. 3), Berlin.
Kühne, K. 1932. „Die Vererbung der Variationen der menschlichen Wirbelsäule", *Zschr. f. Morphologie und Anthropologie*, Bd. 30.
Lartet, E. 1856. "Note sur un grand singe fossile qui se rattache au groupe des singes supérieurs", *C.R. Acad. Sci.*, v. XLIII, Paris.
Lartet, E. 1837. "Note sur la découverte récente d'un mâchoire de singe fossile", *C.R. Acad. Sci.*, v. IV, Paris.
Leakey, L. S. B. 1934. *Adam's Ancestors: an Up-To-Date Outline of What Is Known about the Origin of Man*, London.
Lefrou G. 1956. "Contribution à l'étude de la mimique chez les anthropoïdes: la rire chez les chimpanzés", *Bull. et Mém. Soc. Anthropol.*, Paris. T. 7, fasc. 3-4.
Lefrou, G. 1956. "Contribution à l'étude du comportement des anthropoïdes: la droiterie chez les chimpanzés", *Bull. et Mém. Soc. Anthropol.* Paris, T. 7, fasc. 3-4.
Le Gros Clark (see Clark, le Gros).
Lewis, G. E. 1937. "Taxonomic Syllabus of Sivalic Fossil Anthropoids," *Amer. Journal of Science*, Fifth Series, V. XXXIV, n. 200, August.
Lewis, W. H. and Hartman, C. G. 1933. "Early Cleavage Stages of the Egg of the Monkey (Macacus rhesus)," *Contributions to Embryology*, No. 143.
Loth, E. 1931. *Anthropologie des parties molles (muscles, intestins, vaisseaux, nerfs périphériques)*. Avec une introduction par A. Keith. Varsovie-Paris.
Lotsy, J. P. 1927. "What do We Know of the Descent of Man?" *Genetica*, Deel IX, Aufl. 4–6.
Ludwig, W. 1932. *Das Rechts-Links-Problem im Tierreich und beim Menschen*, Berlin.
Martin, R. *Lehrbuch der Anthropologie in systematischer Darstellung*. Dritte, völlig umgearbeitete und erweiterte Auflage von Karl Paller. Lieferungen 1–8. Stuttgart, 1955–1958. Zweite Auflage Bd. 1–3, Jena, 1928.
Matiegka J. 1934. *Homo Předmostensis*. I. Les crânes. II. Autres parties du squelette, Prague.
Midlo, Charles and Harold Cummins. 1942. "Palmar and Plantar Dermatoglyphics in Primates," *American Anatomical Memoirs*, No. 20, Philadelphia. Wistar Institute of Anatomy and Biology.
Mollison, Th. 1937. „Serologische Untersuchungen am Arteiweiß des Menschen und anderer Primaten", *Verh. Ges. phys. Anthropol.*, Bd. 8.
Monboddo, James Burnett, Lord. 1784–1785. *Das Lord Monboddo Werk von den Ursprüngen und Fortgängen der Sprache*. Übers. von E. A. Schmid. Mit einer Vorrede des Herrn Herder, Bd. 1–2, Riga.
Mourant, A. E. 1954. *The Distribution of the Human Blood Groups*. With a foreword by Professor H. J. Fleure. Oxford, Blackwell.
Negus, V. E. 1949. *The Comparative Anatomy and Physiology of the Larynx*, London.
Nissen, H. W. 1931. "A Field Study of the Chimpanzee," *Comparative Psychology Monographs*, V. 8, No. 1 (ser. No. 36).
Osborn, H. F. 1936. "Proboscidea: a Monograph of the Discovery, Evolution, Migration and Extinction of the Mastodonts and Elephants of the World," New York: American Museum Press.
Owen, R. 1859. "On the Gorilla (Troglodytes gorilla, Savage)." *Proceedings of the Zool. Society*, V. VIII. London.
Patterson, B. 1954. "The Geologic History of Non-Hominid Primates in the Old World," *Human Biology*. V. 26, No. 3.

Philipps, T. 1953. "Pygmies Among Gorillas," *Country Life*, V. 114, No. 2962.

Pilgrim, G. E. 1915. "New Sivalik Primates and Their Bearing on the Questions of the Evolution of Man and the Anthropoids," *Record of Geolog. Survey of India*, XLV, Part I.

Pilgrim, G. E. 1927 Sivapithecus Palate and Other Primate Fossils from India. *Palaeontologia Indica*, V. XIV (N.S.).

Pocock, R. I. 1920, 1925, *On the External Characters of the South American Monkeys*. "Proc. Zool. Soc., London."

Pocock, R. I. 1925. *The External Characters of the Catarrhine Monkeys and Apes*. "Proc. Zool. Soc., London," Part V.

Pocock, R. I. 1928. The Langurs, or Leaf-Monkeys, of British India. *Journal Bombay Natural History Society*, V. 32.

Primatologia. Handbuch der Primatenkunde, Hrsg. von H. Hofer, A. Schultz, D. Sark. Bd. 1, 2, Basel-New York, 1956, 1958.

Quenstedt, W. und Quenstedt, A. 1936. "Hominidae fossiles," *Fossilium Catalogus*, Pars. 74. 's-Gravenhage. Dr. V. Junk.

Ranke, J. 1897. Über die individuellen Variationen im Schädelbau des Menschen. *Korr-Bl. d. deutschen Gesellschaft für Arch., Ethn. und Urgesch.*, Jhrg. 28. München.

Raven, H. C. 1931. "Gorilla: the Greatest of All Apes," *Natural History*, V. 31, No. 3 (May-June). 1932, idem, *Scientific America*, January.

Raven, H. C. 1931. "Hunting the Gorilla," *Evolution*, V. 3, No. 3.

Raven, H. C. et al. 1950. (See the Anatomy of the Gorilla.)

Reck, H. 1933. *Oldoway*. The Ravine of Early Man. The Discovery of Man of Old Stone Age in East Africa, Leipzig.

Remane, A. 1956. „Paläontologie und Evolution der Primaten, besonders der Nicht-Hominoiden". In: *Primatologia*, Bd. I.

Retzius, G. 1922. „Zur Kenntnis der Spermien der Simier", *Biologische Untersuchungen*, Bd. 19, Stockholm.

Reynolds, E. 1931. "The Evolution of the Human Pelvis in Relation to the Mechanics of the Erect Posture," *Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University*, V. XI, No. 5. Cambridge, Massachusetts, U.S.A.

Riesen, A. H., Kinder, E. 1952. *Postural Development of Infant Chimpanzees*. A comparative and normative study based on the Gesell behaviour examination. With a foreword by H. W. Nissen. New Haven, Yale University Press.

Rode, P. 1937. *Les primates de l'Afrique*, Préface de M. le Prof. Bourdelle, Paris.

Rohleder, H. 1918. *Monographien über die Zeugung beim Menschen*. Bd. VI. (Schlußband): *Künstliche Zeugung und Anthropogenie (Menschwerdung)*.

Sanderson, Ivan T. und Steinbacher, George. *Knaurs Affenbuch. Alles über Halbaffen, Affen und andere Herrentiere*. Droemersche Verlagsanstalt, Th. Knauer Nachf., München-Zürich.

Schlaikjer, E. M. S. A. *The Road to Man*. Guide Leaflet Series of the American Museum of Natural History, N. 97.

Schlosser, M. 1911. „Beiträge zur Kenntnis der oligozänen Landsäugetiere aus dem Fayum (Ägypten)". *Beiträge zur Paläont. u. Geol. Österreich-Ungarns usw.*

Schlosser, M. 1924. "Fossil Primates from China," *Palaeontologia Sinica*, ser. 6, V. I, Fasc. 2.

Schoetensack, Otto. 1908. *Der Unterkiefer des Homo Heidelbergensis aus den Sanden von Mauer bei Heidelberg*. Ein Beitrag zur Paläontologie des Menschen, Leipzig.

Schultz, A. H. 1933. „Die Körperproportionen der erwachsenen catarhinen Primaten, mit spezieller Berücksichtigung der Menschenaffen", *Anthropolog. Anzeiger*, Jahrgang X, H. 1.

Schultz, A. H. 1933. *Growth and Development of the Rhesus Monkey (Macaca mulatta)*. Chapter II in: *The Anatomy of the Rhesus Monkey (Macaca mulatta)*, by 19 authors, ed. by Carl G. Hartman and W. L. Straus.

Schultz, A. H. 1936. "Characters Common to Higher Primates and Characters Specific for Man," *The Quarterly Review of Biology*, V. 11, No. 3, No. 4.

Schultz, A. H. 1956. "Postembryonic Age Changes." In: *Primatologia*, Bd. 1.
Schultz, A. H. 1956. "The Occurrence and Frequency of Pathological and Teratological Conditions and of Twinning Among Non-Human Primates. In: *Primatologia*, Bd. 1.

Schwalbe, G. 1923. „Die Abstammung des Menschen und die ältesten Menschenformen", *Die Kultur der Gegenwart*, Th. 3, Abt. 5, Anthropologie, Berlin.

Selenka, E. 1898—1906. Menschenaffen (Anthropomorphae). Studien über Entwicklung und Schädelbau; 4°, Lieferungen I-VIII, Wiesbaden.

Selenka, Leonore und Blanckenhorn, Max. 1911. *Die Pithecanthropus-Schichten auf Java*. Geologische und paläontologische Ergebnisse der Trinil-Expedition (1907 und 1908), Leipzig.

Sergi, Giuseppe. 1911. *Hominidae: Sistema naturale di classificazione*. L'uomo secondo le origini, l'antichita, le variazioni e la distribuzione geografica.

Sergi, S. 1939. „Der Neanderthalschädel von Monte Circeo", *Anthrop. Anzeiger*, Jhr. XVI, H. 14.

Singer, G. C. 1954. "Saldanha Skull from Hopefield, South Africa." *Amer. Jour. of Physical Anthropology*, V. 12, No. 3, September.

Simpson, G. G. 1937. "The Fort Union of the Grazy Mountain Field, Montana and Its Mammalian Faunas." Bull. U.S. Nat. Mus., No. 169.

Simpson, G. G. 1938. "Ice age," *Nature*, V. 141, No. 3570, April 2, Supplement.

Smith, Elliot G. 1931. *The Evolution of Man: Early Man, His Origin, Development and Culture*, London.

Snow, C. E. 1953. "The Ancient Palestinian: Skhul V. Reconstruction." *American School of Prehistoric Research*, Bulletin No. 17.

Sonntag, Ch. 1923. "On the Anatomy, Physiology and Pathology of the Chimpanzee," *Proceedings of Zoological Society*, Part I, London.

Sonntag, Ch. 1924. "On the Anatomy, Physiology and Pathology of the Orang-utan," *Proceedings of Zoological Society*, Part II, London.

Sonntag, Ch. 1931. *The Morphology and Evolution of the Apes and Man*. With a foreword by Prof. G. Elliot Smith.

Spengler, O. 1932. *Der Mensch und die Technik*. Beitrag zu einer Philosophie des Lebens, München.

Stark, Dietrich. 1956. „Primitiventwicklung und Plazentation der Primaten". In: *Primatologia*, Bd. I.

Stolyhwo, K. 1937. "Les Prénéanderthaloïdes et leurs rapports avec la race de Néanderthal," *Bull. Ethnol. du Musée d'Ethnographie de Ljubljana*, t. 10.

Stratz, C. H. 1922. *Naturgeschichte des Menschen. Grundrisse der somatischen Anthropologie*, Stuttgart.

The Anatomy of Gorilla. 1950. The Studies of H. C. Raven et al., ed. by W. K. Gregory, New York, Columbia University Press.

The Anatomy of the Rhesus Monkey (*Macaca mulatta*). 1933. Ed. by C. G. Hartman and W. L. Straus, London.

Tilney, Fr. 1928. *The Brain From Ape to Man*, 2 vols., New York.

Toldt, K. 1932. *Natürliche Färbungen bzw. Zeichnungen der Säugetierhaut*, Leipzig.

Toldt, K. 1935. *Aufbau und natürliche Färbung des Haarkleides der Wildsäugetiere*, Leipzig.

Tratz, E. und Heck Heinz. 1954. „Der afrikanische Anthropoide „Bonobo", eine neue Menschenaffengattung", *Säugetierkundliche Mitteilungen*, Bd. II, H. 3, Stuttgart.

Troisier J. 1928. "Le groupe sanguin II de l'homme chez le chimpanzé", *Annales de l'Institut Pasteur*, t. XLII, No. 4.

Ullrich, H. 1952. „Die phylogenetische Stellung des Menschen und die Schädel aus Süd- und Ostafrika". *Urania*, Jena, Jhg. 15, H. 2.

Ullrich, H. 1953. „Neue Probleme innerhalb der Stammesgeschichte der Menschheit", *Urania*, Jena, Jhr. 16, H. 6, Juni.

Urbain, Ach. et Paul Rode. 1946. *Les singes anthropoïdes*, Paris.

Vallois, H. V. 1954. "Neanderthals and Praesapiens," *Journal Royal Anthropological Institute of Great Britain and Ireland*, V. 84, parts I and II, January-December.
Vallois, H. V. 1956. "Les théories de l'origine de l'homme," *La Nature*, No. 3252.
Vlček K. 1953. "Nalez neandertalského člověka na Slovensku," *Slovenska Archeologia*, Ročnik 1.
Voss, H. 1955. *Bibliographie der Menschenaffen* (*Schimpanse*, *Orang*, *Gorilla*), Jena.
Waardenburg, P. J. 1932. Das menschliche Auge und seine Erbanlagen. *Bibliographia Genetica*, Deel VII, 's-Gravenhage.
Wallis, W. D. 1931. *The Structure of Prehistoric Man.* In: Calverton Y. E. (ed. by). *The Making of Man.* An outline of anthropology, New York.
Weidenreich, F. 1937. *The Dentition of Sinanthropus pekinensis.* A comparative odontography of the hominids. *Paleontologia Sinica*, New Series D, No. 1 (Whole Series, No. 101), Peiping (Peking).
Weidenreich, F. 1938. "Discovery of the femur and the humerus of Sinanthropus pekinensis," *Nature*, V. 1, No. 3570, April 2.
Weidenreich, F. 1943. "The Skull of Sinanthropus pekinensis." A comparative study on a primitive hominid skull. *Paleontologia Sinica*, Series D. No. 10. Peking.
Weidenreich, F. 1947. *Apes, Giants and Man*, Chicago.
Weinert, H. 1951. *Stammesentwicklung der Menschheit*, Braunschweig.
Wendt, R. G. 1934. "Auditory Acuity of Monkeys," *Comparative Psychology Monographs*, V. 10, No. 3 (ser. No. 49), Baltimore.
Werth, E. 1928. *Der fossile Mensch*, Grundzüge einer Paläanthropologie, Berlin.
Yerkes, R. 1934. "Multiple Births in Anthropoid Apes," *Science*, V. 79, No. 2054.
Yerkes, R. 1945. *Chimpanzees*, A Laboratory Colony, New Haven-London.
Yerkes, R. 1952. "Gorilla Census and Study," *J. Mammal*, V. 32, No. 4.
Yerkes, R. and Learned, Blanche W. 1925. *Chimpanzee Intelligence and Vocal Expressions*, Baltimore.
Yerkes, R. and Yerkes, Ada. 1934. *The Great Apes*, New Haven.
Zuckerman, S. 1932. *Social Life of Monkeys and Apes*, London.
Zuckerman, S. 1933. *Functional Affinities of Man, Monkeys and Apes.* A study of the bearing of physiology and behaviour on the taxomony and phylogeny of lemurs, monkeys, apes and man, London.
Zuckerman, S. 1953. "The Breeding Seasons of Mammals in Captivity." *Proc. Zool. Society London*, V. 122, Part 4.

МИХАИЛ НЕСТУРХ

ПРОИСХОЖДЕНИЕ ЧЕЛОВЕКА

Printed in the Union of Soviet Socialist Republics